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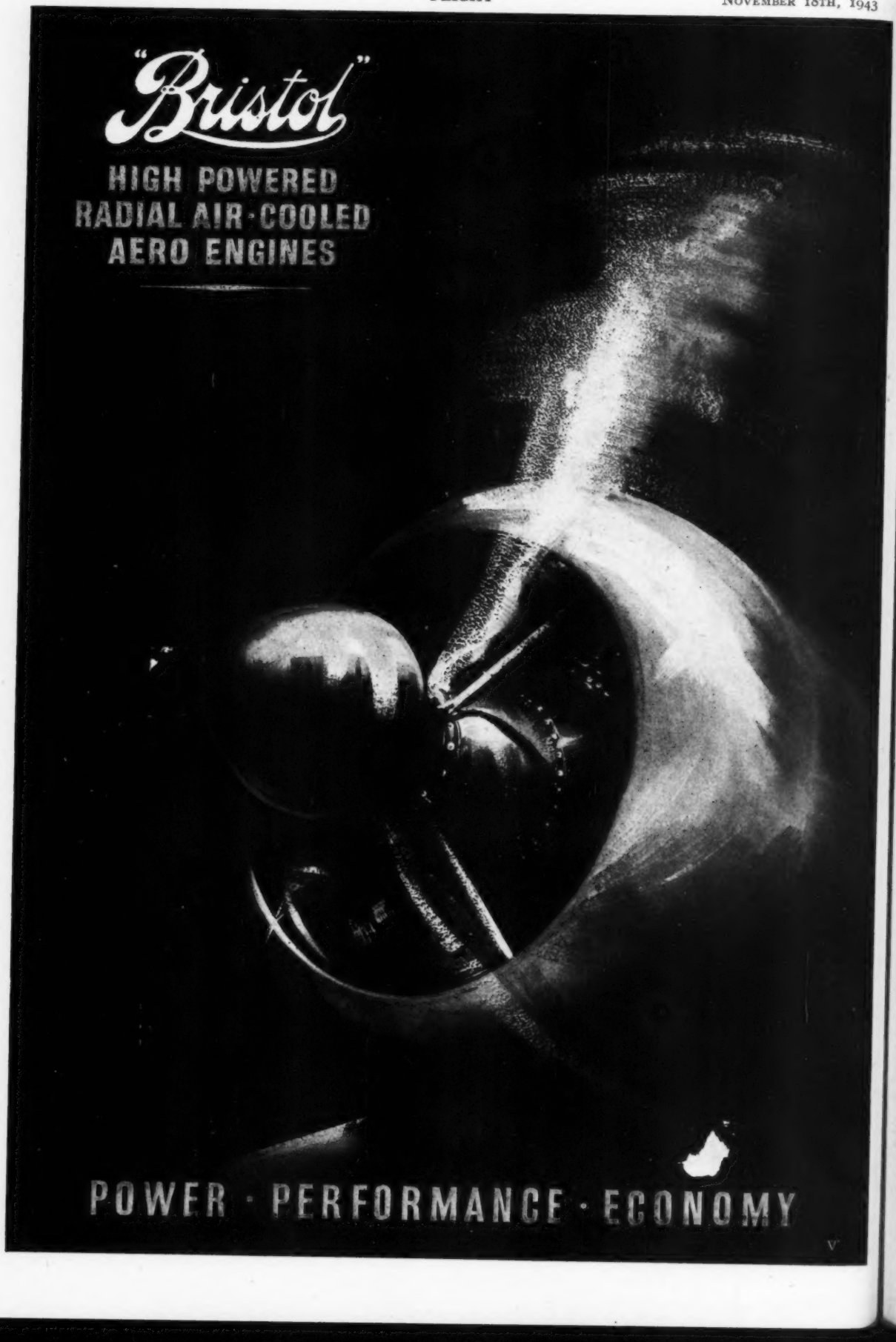
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FLIGHT and The AIRCRAFT ENGINEER

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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The Outlook

"Without Heat or Bitterness"

THE Prime Minister, in his speech at the Guildhall luncheon, urged that when differences of opinion arise between Britons and Americans, even if statements which are malicious are made, there should be no angry rejoinder, and that if facts have to be stated they should be stated without heat or bitterness.

That is an admirable doctrine, and it clearly should be applied also to controversies between other members of the United Nations. It is even possible to read into Mr. Churchill's speech an application of that principle to the Russian view of British and American efforts. In his great speech on November 6th Marshal Stalin acknowledged the help which the Allies had given to Russia, speaking of the Anglo-American bombing offensive as "substantially weakening the military might of the enemy," and admitting that by all their efforts the Allies had "considerably facilitated the successes of our summer campaign."

Then Marshal Stalin went on to say: "Of course, the present operations of the Allied armies in the south of Europe cannot be regarded as a second front, but it is, all the same, something like a second front." Those words certainly express dissatisfaction with the efforts of Britain and America, and other statements and hints from critics in Russia have shown that the bomber offensive has not aroused much enthusiasm there.

It is only fair to remember that Russian military thought regards war as purely a matter of land armies, and the air arm as almost entirely an ancillary of the Russian Army. We may also recall that on many occasions in the past Continental allies and enemies have failed to appreciate the naval power of Britain. The Russian view seems to be that only a landing of Anglo-American forces somewhere in Europe, other than in Italy, would be a true second front which would help them by drawing a number of German divisions away from the Eastern Front. At present they have not found the enemy short of any weapons due to the destruction of his factories, and they seem to overlook the relief given to them by the tying down of perhaps two million Germans on anti-air defence in the west, and the concentration there of two-thirds of the *Luftwaffe's* fighter strength.

It may be (one can only surmise) that it was to correct the prevailing Russian impression that Mr. Churchill used very emphatic terms in his allusions to the bomber offensive. Not long ago he said of it that it was "worth trying," or words to that effect. In his Guildhall speech he said that it, "combined with other blows, may well be the precursor of decisive events in the European struggle," and again: "I rate the Anglo-American attack on Germany as one of the prime causes of the impending ruin of the Hitler régime."

In any event, Stalin has been given a promise that a second front which will satisfy his definition of one is to be opened soon. Such an attack on the German land forces will certainly use up the strategic reserve of weapons at an increased rate, and the bombing offensive will certainly restrict, and in time prevent, the replacement of those weapons.

Crippling Japan

MORE news of the Japanese attempts to reinforce Rabaul have come in since last week, for Col. Knox, Secretary of the U.S. Navy, has stated that the fighting has resulted in the loss or complete disablement of six Japanese cruisers, some of them heavy cruisers, as well as many smaller craft and transports. Seriously damaged warships cannot be repaired

at Rabaul, and it will be a parlous business to get them back to the facilities of Truk, 800 miles away.

As was pointed out in these columns last week, the Japanese hold over their conquests depends in the last resort on their battle fleet, which must come out and fight when challenged by the Navies of Britain and the United States. But a battle fleet is seriously hampered if it is short of cruisers and carriers, and the Japanese have lost heavily in both those classes of warship.

Presumably the Japanese Admiral will manœuvre with the object of fighting outside the range of American shore-based aircraft, and in that case carriers will gain additional importance. The United States is straight away laying down the keels of two enormous carriers, each of 45,000 tons, with a third to follow next year, and American yards build quickly. It would seem to be Japan's best plan to risk a Trafalgar before these carriers are ready to take part.

Good Team Work

DETAILS which have lately come to hand give a gratifying picture of how the Fleet Air Arm and the Royal Air Force worked together in providing fighter cover over the Salerno beaches during the landing.

Problems had to be solved. Large and small carriers were there, but the number of fighters accommodated in a carrier is limited. On the other hand, the N.W. African Air Force had any number of fighters in Sicily, but they could only operate for a short time over Salerno. However, thanks to its numbers and to excellent staff work in arranging for reliefs, the latter managed to keep four fighter squadrons over the beaches all day and every day.

The ship-borne Seafires worked from carriers from the day of the landing, September 9th, until the 12th. The weather was very unsuitable for carrier operations, and by then the escorts were running short of fuel; so the carriers were ordered to withdraw. But a very indifferent landing strip had been cleared at Paestum, so 26 Seafires were sent ashore.

Meantime, R.A.F. Commando men had got ashore and had made a better strip a few miles off, so the Seafires were ordered to move to it, and there they were serviced by R.A.F. crews, whose work won high praise from the naval pilots. On the morning of the 14th the Seafires sent up patrols, but in the afternoon they were ordered to rejoin their carriers, which they did by way of Sicily. During their time ashore they flew 76 sorties. The number of sorties from the carriers has naturally not been published, as it would help the enemy.

The fighters of the N.W.A. Air Forces naturally flew a very much greater number of sorties, actually 2,800 during the first four days of the fighting, before landing in Italy. Tactically, the two lots of fighters combined so well that the Germans made no serious attempt to challenge the Allied mastery of the air.

There should be no question of claiming greater credit for one Service or the other. Each had its difficulties to overcome, both worked together in the right spirit, and the result was eminently satisfactory to the Army.

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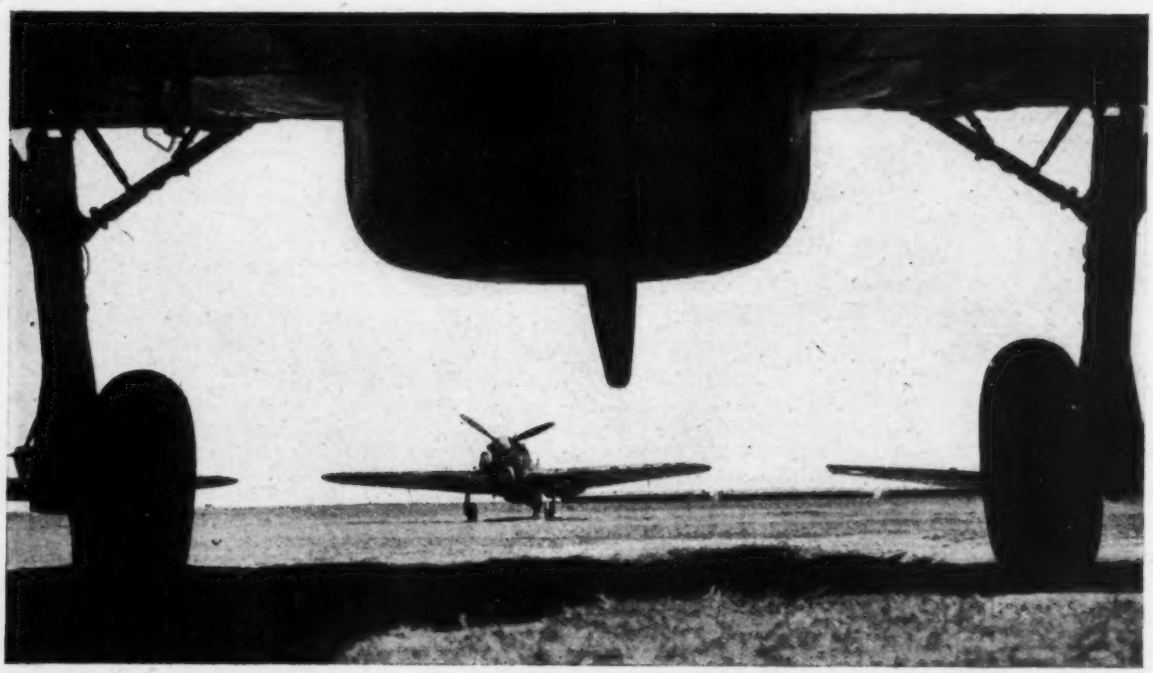


TRAINING IN INDIA: Mark I Hurricanes and a Harvard framed by the undercarriage of another Hurricane. The scene is at one of the many R.A.F. flying training establishments in India.

WAR in the AIR

German Policy of Conserving Fighters : Alps Supply Railways Bombed Again : MacArthur's Combined Operations

THE state in which the *Luftwaffe* now finds itself is well illustrated by official reports of Allied sweeps over France and the Low Countries. One communiqué issued last week told how American Marauders, escorted by Spitfires, attacked the German bomber base at Chievres, near Brussels, and dropped bombs in the midst of some 30 twin-engined bombers on the ground. *No fighter opposition was encountered.* Thunderbolts, Typhoon bombers and Typhoon fighters, with other Spitfires, swept over northern France, while Whirlwind bombers damaged three coastal vessels near Guernsey. During the day a good 500 sorties were made, and only one fighter failed to reach its base by the evening. Where were the German fighters? The answer is that they were all aground, as snugly as they could contrive, "according to plan."

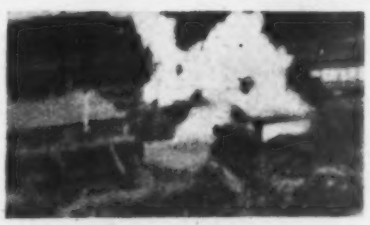
In this case those words, ominous as they usually are, were strictly correct. The order has gone forth that the gauge so constantly thrown down by the British and Americans is only to be picked up if the target attacked is thought really worth a resolute and probably expensive defence. The Allies want to kill German fighters; they want to prod them into showing fight. To do them justice the German fighter pilots are probably quite ready to oblige, but higher authority has stepped in and decreed that fighters are now so precious that they must not be risked in combat except for very special reasons.

For the same cause the *Luftwaffe's* night raiding has developed into the "scalded cat" tactics, to use the words of the Air Minister. Very few raiders come over, and most of them are fast machines, largely Fw 190s and Me 410s, which are only too anxious to get rid of their bombs and scurry home again before the Mosquitoes get on their tracks. They have lost a high percentage of their numbers, but the gross loss has been trifling compared to what it might be if they disputed with a strong force of Spitfires over France by day.

When Bomber Command sends out its Lancasters, Stirlings and Halifaxes to batter a German production centre, the enemy fighters have to attack it, win or lose. Likewise the Germans have seen the necessity of building up in the west a mixed body of aircraft to meet the coming invasion. Bombers and submarines constitute the greatest menace to the ships when an invasion is in progress, and if the bombers (including torpedo-bombers) are to have a chance, the fighters must give them a reasonable measure of protection. So the Germans have doubled the strength of their fighters in the west since January, and it is now three times as large as the fighter strength on the Eastern Front. That must have been a great effort, and must have caused many searchings of heart.

At that critical moment Fortresses of the North West Africa Air Force flew to the north of the Alps and bombed the Messerschmitt factory at Wiener Neustadt. Result: so many less fighters for the *Luftwaffe* in the future. Bombing a fighter factory probably has a more immediate effect

EIGHTH ARMY EYES : An air observation squadron operating Taylorcraft Auster IIIs in Italy.



ENGINE OF DESTRUCTION : A cannon attack on a railway engine in Belgium as seen by the camera on the attacking Typhoon.

WAR IN THE AIR

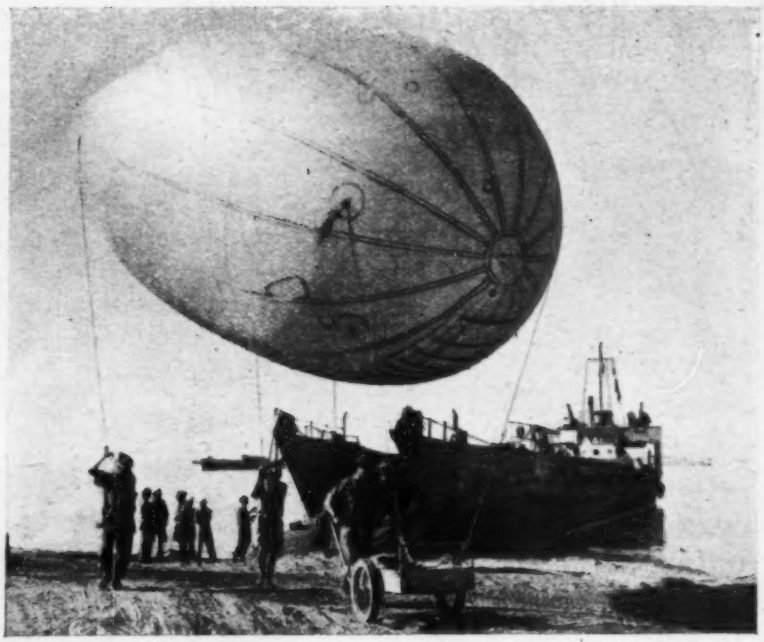
just now than bombing any other form of target. Of course the Germans had seen the threat coming from the south, and so, in addition to all their other anxieties, they had to build up an air force to meet it. They got some machines from the factories (doubtless some from Wiener Neustadt while it was still producing) but for the most part they had to withdraw squadrons from the two Army fronts in Russia and Italy. No wonder the Fifteenth Army Group in Italy found the resistance in the air quite inconsiderable, and could send its vehicles along the roads nose to tail. However, there has been some stiffening of German resistance in Italy of late. Papers have been captured ordering the German troops to hold the line north of the Volturno for eight weeks, and troops cannot be expected to make a resolute stand unless they get at least some help from their own air arm.

One striking result of the withdrawal of German fighters to the West can be found in the Russian communiqués. Not long ago they were reporting large numbers of German aircraft destroyed, which was what one would expect. Then, rather suddenly, one noticed that the Russians began to claim only very moderate or small numbers of victims. For November 11th, for instance, they only claimed that 19 German machines had been shot down in the day.

Carriers in the Pacific

THE Navy Department at Washington has made an interesting disclosure, namely, that at the attack on Wake Island on October 5th and 6th last the American fleet employed more aircraft carriers than were ever assembled before in one place in naval history. The Assistant Secretary for the Navy, Mr. R. Bard, went on to argue against the view that carriers could never be effective against shore-based aircraft, because, it was said, they would have to use all their fighters to protect the carriers themselves. To us it seems to be a question of numbers, the number of shore-based machines compared with the numbers which the carriers can put into the air.

Another extremely interesting piece of news from America is that for the future the war against U-boats will be conducted, not by the Army Air Force, as hitherto, but by American Naval Aviation, a term which includes what we call the Fleet Air Arm and Coastal Command combined. This change is stated to be a result of American aircraft expansion. The Army Air Forces are now piling up strength in the United Kingdom and elsewhere, and so need all their machines; while Naval Aviation has got over its first throes of expansion and is now strong enough to take over work which is certainly naval in character.



SALERNO SAUSAGE : A barrage balloon being brought ashore from a landing craft at the Salerno beaches. The weighted hand-cart is a gem of improvisation.

FOR GROUND STRAFING : Re-arming the .5in. machine guns in the port wing of a Warhawk.

German Supply Lines in Italy

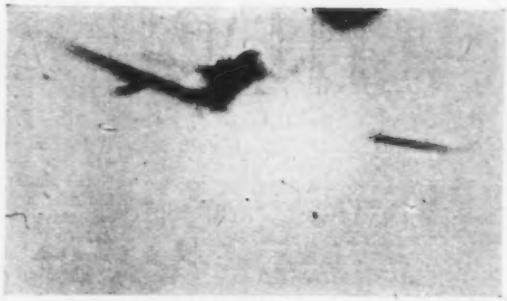
THE Alps form a great bastion for Italy, though numerous invaders from Hannibal to Napoleon have succeeded in crossing them. But when an army in Italy is fighting on the defensive and must draw its supplies from beyond the Alps, the mountains are not regarded by that army as the best of friends. The railway tunnels through the mountains become of supreme importance, and Rommel is now very dependent on the two lines through the Brenner and Mont Cenis. The actual Brenner Pass is difficult to locate from the air, but traffic can be stopped, or at least hampered, by bombing the railway junctions to the south of it. The Mont Cenis Pass is easy to identify, because at the French

WAR IN THE AIR

ENEMY AIR LOSSES TO NOV. 13th

	Over G.B.	Continent	Middle East	N.W. Africa
Nov. 7	3	1	0	2
,, 8	3	0	0	1
,, 9	0	1	2	38
,, 10	0	0	1	4
,, 11	0	4	5	3
,, 12	0	0	0	5
,, 13	0	0	1	9
	6	6	9	62

Totals: West, 7,712; Middle East, over 5,749; North-West Africa, 3,614.



ROCKETING ROCKETEER: A rocket-gun-carrying FW190 being shot down by a U.S. Thunderbolt. The rocket apparatus can be seen under the port wing. When the Fortress bombers were not escorted the Germans broke up the formations by means of rocket propelled shells. The escorting Lightnings and Thunderbolts now ward off these attacks.

end of the tunnel lies the town of Modane.

Action has been taken against both these routes before, but railway lines can be repaired in a reasonable time, and the bombing must be repeated if the route is to be kept out of commission. So last week the Strategic Force of the N.W. African Air Forces struck by day at the lines running south from the Brenner, while Bomber Command sent a force by night from England to knock sparks out of the railway station at Modane. This second attack undid the labours of a month. As for the sparks, they were literal and not merely proverbial, for it seems that there was an ammunition train in the station.

The Dodecanese

CONSIDERING the superiority of Allied sea power in the Mediterranean, it is hard to understand why the Germans are able to invade the islands of the Dodecanese which the British had occupied with obviously inadequate forces. Cos has now become a useful air base for them, and attacks by the Middle East bombers have not put its airfield at Antimachia out of commission. At Leros, which is valuable on account of its harbour, our old friend the Stuka has made a come-back, and has been diving on the British and Italian gunners and infantry. Reports say that the Italians fought well. They would naturally do better when on the side of their old and natural Allies than they did when serving the hated Hun.

Another case of withdrawing troops from an island "after accomplishing their mission" has occurred in the Solomons. American parachutists had landed on the island of Choiseul, and after that a landing was made on the more important island of Bougainville. Since then the parachutists have been withdrawn from Choiseul, and the phrase used to explain the withdrawal was ominously like that used when the survivors of the British force on Cos were evacuated. It does not follow, however, that the conditions were similar. Choiseul may be of less importance now that there is fighting on Bougainville, and Gen. MacArthur may have needed that parachute force for another job. Rabaul continues to be the scene of attempts to reinforce by the Japanese and of raiding by American bombers. Sea fights have also taken place. Gen. MacArthur uses each arm in turn as best suits his purpose.

BRITISH & U.S. AIR LOSSES TO NOV. 13th

	Over G.B. A'crft.	Continent B'brs.	Continent F'trs.	Middle East A'crft.	N.W. Africa A'crft.
Nov. 7	0	1	2	0	1
8	0	1	0	0	0
9	0	0	5	3	0
10	0	0	3	3	2
11	0	11	7	1	4
12	0	0	1	2	3
13	0	15	16	4	1
	0	28	34	13	11

Totals: West, 8,364; Middle East, about 2,322; North-West Africa, 1,337.

MOUNTAIN RESCUE: There is a R.A.F. Mountain Rescue Service specially trained to bring aid to occupants of aircraft unfortunate enough to crash where they cannot be reached by ordinary transport. All the personnel are experienced mountaineers.

U.S. Raids on Bremen

LEROS was not the only place where the once triumphant Stuka has been hauled out of its obscurity and sent into battle once again. The idea of using a slow and clumsy dive-bomber, a machine which is of no use except for dive-bombing ground targets, against a daylight bombing raid is extremely curious. Yet when the American Eighth Air Force flew out against Bremen last Saturday, with a strong escort of Thunderbolts and Lightnings, some Ju 87s were seen among the varied assortment of aircraft which the Germans sent up against the raiders. One has heard suggestions put forward before now that one good answer to the bomber would be to bomb it from the air, and the Germans have made some experiments in that direction of late, without any encouraging results. The raid was notable for another point; it was the longest penetration which American escort fighters have yet made into Germany.

The weather was bad for flying last week-end, but nevertheless Typhoons and other fighters have continued to raid every day, and Mosquitoes have been out over Germany most nights. On last Saturday night they went as far as Berlin, and all got back safely

HERE AND THERE

Flying Visit

SIR FRANK SPRIGGS, Mr. R. H. Dobson, Mr. R. Chadwick and Mr. H. A. Brown, of the Hawker Siddeley group, have just returned from a flying visit to Canada in an Avro York. The flight from Montreal took 10 hr. 25 min.

They have been inspecting aircraft factories in the Dominion.

Three-to-One, the Allies!

ON the anniversary of the American Army's purchase of its first aircraft 34 years ago, the U.S.A.A.F. issued the statement that the 4,500 aircraft it now receives each month exceed the total output of the Axis.

Total U.S. aircraft production exceeded 8,000 in October, added to which Great Britain and Russia are together building more aircraft than the Axis, whose total output is estimated to be not more than 4,000 a month, of which Germany supplies rather more than half.

Thus the total Allied aircraft output is to-day at least three times that of the enemy—a fact which Hitler did *not* mention in his recent "pep talk."

Not So

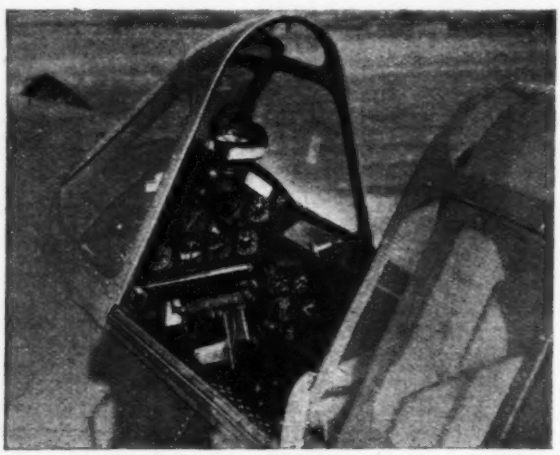
REPLYING to a report that negotiations had been begun by the U.S. with the Australian and New Zealand Governments for the use of naval air bases after the war, Mr. J. Curtin, the Australian Premier, recently denied that any such proposal had been made by any country, nor had there been any proposal for handing over territory for post-war use as a naval base.

No reference was made to possible bases for civil flying boats.

Transatlantic Tour

MR. C. M. NEWTON, chairman of the Aerodrome Owners' Association, and Alderman O. C. Purnell, C.B.E., a member of the association's executive committee, have gone to America by air to study in detail Canadian and U.S. civil airports.

The tour is expected to last a month and to cover coast-to-coast airports.



HELLCAT'S COCKPIT: The Grumman Hellcat, a development of the Martlet (or Wildcat in the U.S. Navy) is now in service with the Fleet Air Arm. This picture shows its compact cockpit and instrument panel.

The British visitors have been granted facilities to study all aspects of operation, maintenance and management.

Mr. Newton has been a member of the Aerodrome Owners' Association since it was formed under that title in 1935. He is also a director of Sywell Aerodrome, Ltd., Northampton.

Alderman Purnell is closely connected with Cardiff Municipal Airport.

U.S. Air Picture

PREDICTIONS of "things to come" in America's post-war air age were made by prominent members of the country's air transport industry and Government air experts who recently held a conference in Washington.

This picture of intense air activity includes transport tugs with trains of gliders flying under semi-automatic control through the stratosphere, huge passenger and freight airliners, and, at the other ends of the scale, small, low-cost family aircraft.

A few years after the war, it was forecast, the United States would have 6,000 airports and something like 300,000 private aircraft in operation.

No Fear of U.S. Competition

BRITAIN has no need to fear competition from America in post-war civil aviation.

This reassuring view was expressed recently by Lord Brabazon when addressing the London Publicity Club. "America," he said, "may have an advantage at first, but we will soon get back to the position that we are in on the military side to-day."

London would be the headquarters of European air transport after the war, and he saw no incentive for America to run air services via Europe to the East or Africa; she would have a tremendous job linking up the two Americas and dealing with the Pacific.

Pennsylvanian Plans

PENNSYLVANIA Central Airlines, according to a Reuter message, has placed before the Civil Aeronautics

ANOTHER FOR THE NAVY: The Vought Corsair, another American fighter now coming into service with the Fleet Air Arm, is credited with a top speed of 400 m.p.h. Its cranked wings, with oil-coolers in the leading edge, are prominent features. Note the tail hook for engaging deck arrester-gear.

HERE AND THERE

Board of America a plan for a new 8,000 miles air network through the Caribbean Sea, linking Latin America directly with industrial Pennsylvania, Ohio and Michigan via New Orleans and Miami.

Yorks for B.O.A.

IT is reported that British Overseas Airways Corporation is likely to have a number of new land aircraft and flying boats shortly, and that the York will soon be operating on some of their routes.

Yorks are now being used by the R.A.F. Air Transport Command.

R.C.A.F. Staff Changes

AIR MARSHAL LLOYD S. BREADNER, Chief of the Air Staff, R.C.A.F., is to succeed Air Marshal H. Edwards as Air Officer Commanding-in-Chief, R.C.A.F., Oversea. Air Marshal Edwards is to take up an appointment in Canada. Hitherto the Air Officer Commanding-in-Chief Oversea has been responsible to the Chief of Air Staff in Canada, but Air Marshal Breadner will be directly responsible to the Air Ministry.

Air Marshal Robert Leckie will, in turn, succeed Air Marshal Breadner here.

Scientific Collaboration

SIR GEORGE THOMSON, F.R.S., who is Professor of Physics at the Imperial College of Science, has been appointed scientific adviser to the Air Ministry and will be responsible for examining air operations from the scientific aspect, including methods, weapons and equipment employed. He will also advise the Air Staff and other Air Ministry Departments on these matters.

Sir George will work in consultation with Sir Robert Watson-Watt, Scientific Adviser on Telecommunication, on all questions affecting radio-communication and radiolocation.

Nuffield Training Scheme

A TRAINING and welfare scheme under which approved apprentices will receive free technical education and be able to gain scholarships to the universities is being introduced in the Nuffield organisation.

Wages at not less than the standard rate will be paid during apprenticeship, and an important aspect of the welfare side is the subsidising of the midday meal for all those under 18.

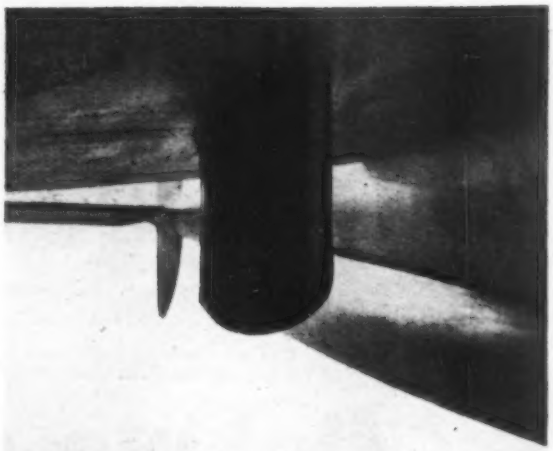
The scheme is described as "a practical step in planning for the future of Britain's industry and to ensure her world markets."

Benevolent Fund for No. 603 Sqn.

NEARLY £4,000 has already been received towards the £10,000 benevolent fund which is being raised for the City of Edinburgh No. 603 (Fighter) Squadron.

The Lord Provost, Sir William Darling, who presides over the committee, recently emphasised at a meeting in the City Chamber that the fund was intended to meet the post-war needs of those who had served in the squadron either as air or ground crew.

Some part of their needs, he said, would undoubtedly be met by the Government, but there would remain a large amount of hardship and suffering which could best be met by a fund of this kind.



IT ALL DEPENDS. This streamlined fitting, depending from the Lightning's centre-section on each side of the pilot's nacelle, carries either bomb or extra fuel tank.

U.S. to Double Fuel Output

AMERICA'S output of 100 octane aviation spirit is to be doubled in the next twelve months, says a Reuter message reporting a statement by Mr. Harold Ickes, U.S. Secretary of the Interior and Petroleum Administrator.

Mr. Ickes added that 26 new refineries would begin operations between now and next spring; he was speaking at the opening of a new £3,250,000 oil plant at Marcus Hook, Pennsylvania.

Ancient Gongs

AN anonymous donor has presented to the Royal Aeronautical Society a remarkable collection of more than 300 aeronautical medals dating from 1714 to 1941.

Since every one was struck on the occasion of some outstanding event, the collection forms a veritable history in metal of aeronautics.

Three of the early medals in this collection were struck in 1783 to commemorate the first ascent of the Montgolfier Brothers in a hot-air balloon, and two others show the ascent of Lunardi from London in 1784.

James Sadler, the first Englishman to make an ascent, is shown on a medal dated 1811, and a silver medal struck in 1851 shows the ascents of three balloonists, each on a horse!

"—and then with a final twenty-minute burst, I more or less dismantles the entire aircraft."

The 1909 Congress medal to the Wright Brothers, and others in honour of Bleriot's 1909 cross-Channel flight, Paulhan's 1910 London-Manchester effort, and similarly historic events, are all included.

"Parascooters"

MINIATURE motor cycles, reminiscent of the motor scooter popular in the nineteen-twenties, but far sturdier, are now included in the equipment dropped by parachute to increase the mobility of British airborne troops.

Powered by a 98 c.c. Villiers two-stroke engine embodying a hand-controlled clutch, similar to those fitted to the familiar autocycle, these "parascooters" are capable of at least 30 m.p.h., can traverse rough ground, yet can be carried like a suitcase. With telescopic seat pillars and handlebars that fold flat, they are dropped in containers.

A Ministry of Supply exhibition of the varied equipment of airborne troops was opened in London last week by Maj. Gen. F. A. M. Browning, G.O.C. Airborne Forces.

Technical Training

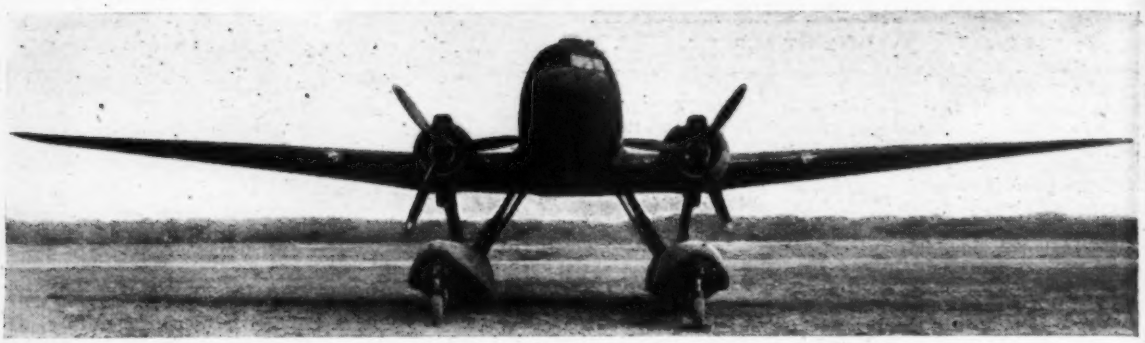
THE need for the more advanced technical training of aircraft engineers, and for greatly improved research facilities was stressed by Mr. Norman Biles, of Blackburn Aircraft, Ltd., when he recently addressed Hull Rotary Club.

The industry, which was faced with a grave dearth of trained men at the outbreak of war, was alive to this need, he said, and the position must be remedied.

Sir Roy Feddon's mission to the U.S. served to throw fresh emphasis on the relative weakness of our position as regards technical education, and undoubtedly big developments in the direction of improved facilities could fairly confidently be expected before very long; Government action could not be long delayed.

Mr. Biles mentioned that Cambridge and Hull were at present the only two universities in Britain with chairs of aeronautical engineering, and he referred to the Blackburn company's apprenticeship scheme under which students were assisted by local scholarships while at the university.

D



The Douglas C-53 is a development of the DC-3 (British version Dakota). Its conversion into a seaplane is interesting. Note particularly that the floats have nose wheels in addition to the wheels under the step.

Dakota on Floats

The U.S. Army C-47 and C-53 Transport

By H. W. PERRY

POST-WAR passenger and cargo air transport can be partly forecast from the record made by the Douglas Skytrooper and Skytrain and their predecessor, the DC-3, during and before the war. Nearly 600 DC-3s had been delivered to commercial airlines before the United States entered the war and were then the only transports being manufactured in what was, for the time, large numbers. Up to April 1, 1942, these had flown a total of 300,000,000 air miles in scheduled domestic airline service, and were daily flying long international routes.

Pan American Airways used these machines late in 1941 to break the hold of German and Italian airlines on the economic life of the South American countries so that they could sever relations with the Axis nations. And in 1942 the Pan American DC-3s flew 8,000,000 air miles between the United States and South America, and between the several countries of the southern continent, thereby helping to prevent collapse of their national economy.

Conversion to Seaplane

When, therefore, the U.S. Army required cargo and troop transports for global service, it turned to Douglas, although doubting whether the DC-3 landplanes could carry sufficiently heavy loads over long water routes which seemed to call for use of flying boats. Up to that time, regulations of the Civil Aeronautics Authority restricted the craft to a gross weight of 26,500 lb., with payloads limited to 5,000 lb. However, the addition of pontoons having retractable landing wheels, quickly converted them into seaplanes, and the margin of safety built into them enabled pilots to begin at once to fly them in routine operations with double the payload and at a gross weight of 31,000 lb. on long overwater trips.

So, in 1942, the American Air Transport Command was able to carry fifty times more air freight in these machines than had been carried by all domestic airlines in 1941.

The C53 Skytrooper is the DC-3 modified internally as a troop transport. The C-47 Skytrain differs only by the addition of a large goods door. Both have a 95ft. wing span, weigh 16,500 lb., are powered with two 1,200 h.p. engines, and have a speed exceeding 225 m.p.h.

A majority of the DC-3 transports delivered before 1942 have been in the service of the air transport and troop carrier commands of the U.S. Army since then, and the number of C-47s and C-53s has been enormously increased.

From the capture of the Burma end of the Burma Road by the Japanese, these three types have provided the only contact of free China with the outside world, and the only means of conveying aviation fuel to General Chennault's Flying Tigers, now the Tenth Air Force. They proved capable of surpassing the former service ceiling of the DC-3 and able to transport as much freight each as fourteen motor vans in a given time.

Across Africa

They also made possible the establishment of the air route from the United States via Brazil and across Central Africa to Egypt, Iran and India for the rapid transport of high military and civilian officials and of most urgently needed supplies.

Following landing of the U.S. Marines on Guadalcanal in the Solomons, fourteen especially equipped C-47s were flown from San Diego, on the Pacific Coast, to New Caledonia and maintained daily service to Guadalcanal from September 1, 1942, to February 1, 1943, except for one 24 hr. period. These supplied the American force on the island with essential food, fuel, ammunition and medicines during the time while sea communications were severed. Together with others added to the Command, they made almost 1,000 flights to the island, each time evacuating wounded men to base hospitals and thereby enabling the saving of thousands of lives.

(*Continued at foot of next page*)

The C-53 is known as the Skytrooper and is a troop transport. The C-47 Skytrain is similar, but has a large door for loading bulky goods.

It is safe to say that Port Moresby, on New Guinea, was saved from Japanese capture largely by C-47s, which moved some 7,000 Australian and American troops over the Owen Stanley Mountains to the north coast of the island and kept them supplied with provisions and munitions during the campaign, which eventually resulted in the taking of Lae and Salamaua in September of this year.

Forty-four of these Douglas aircraft made a mass flight with paratroops from England to Oran prior to British and American landing operations in North Africa, and dropped the men without accident. They likewise played an important rôle in the invasion of Sicily. In the Far North, C-47s are operating over the land route to Alaska, and the U.S. Army is using them for important supply activities.

The intruder Mosquito after it had landed. Why bother to have such things as carefully balanced rudders?

Mosquito Makes Base

Intruder in Flames from Oil of Destroyed Enemy

A DE HAVILLAND Mosquito, of Fighter Command, out on intruder patrol one night during last September, attacked at close range a Dornier 217 which was on its way home. Following a well-directed burst of fire the Dornier exploded, and the Mosquito caught fire from the backwash of burning oil thrown out.

Flt. Lt. M. A. Cybulski, the pilot, was temporarily blinded by the explosion, and the navigator, F/O. H. H. Ladbrook, had to rescue the Mosquito from the uncontrolled dive into which it had been thrown. The pilot then recovered and course was set for base.

To add to their troubles on the way home, the airscrew of the port Merlin had to be fully feathered because the engine had been damaged by flying débris from the Dornier. This made the Mosquito extremely difficult to handle, because most of the fabric had been burned off the rudder and there was insufficient surface left to counteract the turning moment caused by the dead engine.

After they had landed at their base a closer inspection revealed that, besides the trouble from burning, the fabric on the port wing (inboard of the engine), on the underside of the starboard wing, and on the port tailplane, had been damaged and torn loose by the slipstream. It was then fully realised what a fantastic sight the aircraft must have presented at the time of the incident.

For this flight and for other outstanding work on intruder sorties, Flt. Lt. M. A. Cybulski (R.C.A.F.) and F/O. H. H. Ladbrook (R.A.F.V.R.), both of No. 410 (R.C.A.F.) Squadron, have been awarded Distinguished Flying Crosses.

Another view of the damaged Mosquito showing the port airscrew feathered and the fabric torn away from the nose. Flt. Lt. Cybulski (left) and F/O. Ladbrook by their damaged machine.

LUFTWAFFE'S "MOST SURPRISING DISCOVERY"

CARL ZEPPELIN, air correspondent of the German overseas news agency, recently wrote "The most surprising discovery of the *Luftwaffe* since the arrival of the first U.S. air units in the European theatre of war has been that most of the U.S. bombers do not carry bomb sights during their attacks. That goes for the large four-engined bombers as well as the smaller marauders.

"Only the leading plane has the task of finding the target with its bomb sight. All the other bombers drop their load after a signal given by the leading aircraft. This is called carpet bombing. Other discoveries have also been made. For instance, Fortress-type bombers carry a small bomb-load, as nearly a third of their weight-carrying capacity is used in armour."

Castor Shimmy

Its Prevention by the Use of Twin-contact Tyres: Curing the Trouble at its Source by Reducing the Forcing Effect

By MAJOR O. J. MARSTRAND,
M.C., B.Sc., A.F.R.Ae.S., M.I.Mech.E., A.M.I.E.E.

"SHIMMY" is the slang term applied to the oscillations of a self-aligning or castoring wheel which may result from a sideways displacement of the wheel. This tendency, in some cases amounting to an actual building-up of oscillations, is unpleasant in a tail wheel: in a nose wheel it may become highly dangerous.

The use of two rolling discs, laterally separated and coupled in rotation, has in itself an important bearing on the prevention of shimmy, but it is the use of a tyre of special shape which forms the patent subject of the tail wheel invented by Major Armstrong and developed jointly by him and the Dunlop Rubber Company.

A twin-contact tyre of the type now seen on many aircraft.

THE tendency of a freely castoring wheel to shimmy under certain conditions is well known; a familiar example is that of luggage truck castors on railway station platforms. When castoring tail wheels took the place of tail skids on aircraft, the problem of suppressing shimmy arose; later, as the use of runways instead of grass airfield surfaces increased, this problem became more acute, both in the case of tail wheels and in that of nose wheels.

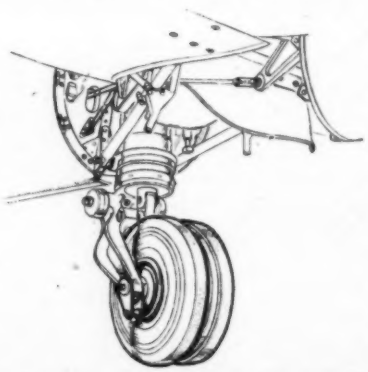
It can be seen that the self-aligning action characteristic of all castors in motion, together with their inertia, will tend to cause such a castor, after an initial side disturbance, to swing not only into the main direction of motion but past it, and so to oscillate about it. In any actual castor, besides this obvious effect, there are forcing and damping effects. Where the latter predominate at all amplitudes of swing (including zero), shimmy will be suppressed; otherwise it will continue after a sufficiently large disturbance, or, in some cases, even build up after any disturbance, however small. The causes of shimmy have been investigated by Dr. G. Temple, F.R.S., who has also estimated the amount of damping required to prevent it.

Effect of Side Flexibility

Briefly, forcing effects are chiefly due to side flexibility (considerable in pneumatic tyres); these effects are enhanced, in the writer's opinion, by the usual round external shape of the tyre section, when rolling is taken into account.

Two important damping effects are: first, any resistance of the pivot to turning; secondly, frictional resistance between the ground and tyre contact surfaces, opposing the twisting of one relative to the other which is seen to be associated with shimmy.

These damping effects are always present, but may sometimes not be strong enough to suppress shimmy unless increased by special methods. The usual method has been to introduce at the pivot extra frictional or hydraulic resistance to turning. Friction damping is simple but it does not decrease to zero with the angle of deflection, whereas the self-aligning forces do, so that complete alignment is impeded. Hydraulic damping varies with the speed of swing and so does not impede a steady taking up of alignment, but it is sometimes more complicated. Both require adjustment and maintenance, which are not always easy matters. Pivot damping cannot be made to adjust itself to vary with the coefficient of ground friction, which varies, for instance, with the wetness or dryness of the ground, so that the forcing effects vary correspondingly in magnitude.



A Marstrand tyre on the retracting tail wheel of a Mosquito.

It is often suggested that self-centring by elastic or other similar means will stop shimmy, but it can be seen that such an action is of a similar nature to the self-aligning effects which maintain this oscillation. It is true, none the less, that devices fitted for this purpose may help, chiefly on account of the extra incidental friction introduced. However, such frictional damping has the limitations mentioned above, of damping generally, when applied at the castor axis.

Increased Damping Action

The twin-contact tyre has been designed to reduce the forcing effects and to increase the damping action at the ground contact area, dispensing with or reducing the amounts of damping or self-centring applied at the pivot. The outer cover, the appearance and construction of which are shown in the accompanying photograph and drawing, the tube, and the wheel are of ordinary size and shape, the only difference from previous practice being in the contour of the tread, which is moulded so as to have on it the two ring-shaped ridges which are the only parts in contact with the ground. When the wheel forks have been designed for the previous shape of tyre, the internal size of the twin-contact cover (and hence the size of the tube) usually has to be somewhat reduced to give clearance in the forks for the outer edges of the two treads, but when forks and tyre are designed together they naturally conform in shape and there are then no necessary effects on tube size or on the overall dimensions of the complete castor.

Briefly, the effectiveness of this tyre in suppressing shimmy is considered to be due to three main causes. First, it is stiff sideways, especially when in rapid rotation, so that the first shimmy forcing effect mentioned is reduced. Secondly, no part of the curved walls touches the ground, so that the second forcing effect is also reduced. Thirdly, the two contact rings will evidently resist the twisting relative to each other which is neces-

(*Continued at foot of page* 555.)

Civil Aircrews and Post-war Flying

G.A.P.A.N. and B.A.L.P.A. Plan Future Together

THE following declaration of policy has been issued jointly by the representatives of the Guild of Air Pilots and the British Air Line Pilots' Association.

In anticipation that there will shortly be a Government policy for civil aviation which will control its immediate and future development, the Guild of Air Pilots and Air Navigators of the British Empire (G.A.P.A.N.) and the British Air Line Pilots' Association (B.A.L.P.A.) have held a series of joint discussions.

The two bodies have considered their activities in connection with the well-being, status and professional skill of present and future civil flying personnel. Captains of aircraft, pilots of whatever other category, and many others who will depend for their living on the air, will find that their career is dependent to a large extent upon the outcome of the present Government discussions and resultant policy. The G.A.P.A.N. and the B.A.L.P.A. in their respective spheres are determined to do all they can for those whose career will be affected.

The G.A.P.A.N. will continue to foster the standards of apprenticeship, professional skill and charitable objectives which are traditional with City Guilds; B.A.L.P.A., which is already affiliated with the Trades Union Congress, will continue to uphold the standards of professional skill and conditions of service of air line pilots and, in addition, will assume care of the conditions of service of other commercial pilots and navigators, including test pilots and instructors. Both bodies will encourage and assist Service personnel who decide to make civil aviation their future career. Further, both, in full appreciation of their community of interest with licensed aircraft engineers, radio operators, etc., will collaborate with their chosen representatives.

The G.A.P.A.N. advises its members and Service personnel who have registered with it to support the B.A.L.P.A. by applying for membership forthwith. The two bodies will work together for the advancement of knowledge in all branches of practical aviation, for the setting up of proper standards of proficiency, and to ensure the public safety under all conditions of flight. Where necessary they will make joint representations in all matters affecting air pilots and crews now and in the future. Regular joint meetings are being continued to this end.

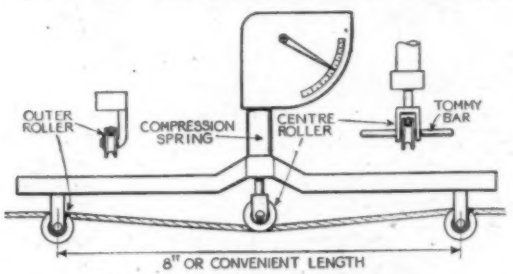
For the British Air Line Pilots' Association,
7, Park Lane, London, W.1.
(Signed) M. J. R. ALDERSON, Vice-Chairman.
A. D. SAWARD, Secretary.

For the Guild of Air Pilots' War Emergency Committee,
61, Cheapside, London, E.C.2.
(Signed) A. G. LAMPLUGH, Chairman.
LAWRENCE WINGFIELD, Clerk.

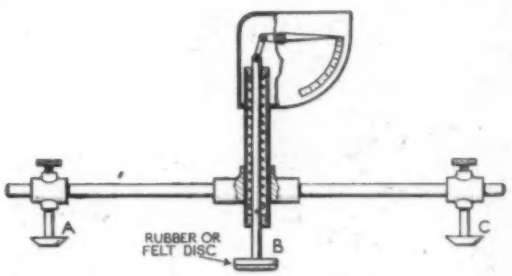
Tension Meters

Test Pilot's Gift to Industry

FROM Mr. J. A. Crosby Warren we have received rough sketches of two tension meters which he has developed for testing fabric-covered control surfaces and control cables. Mr. Crosby Warren is in charge of production flight testing for the Gloster Aircraft Co., Ltd., and has found these two tension meters to work very well. He claims no patent on them, although they appear to be original, and has no objection to anyone in the aircraft industry making what use they like of the scheme.



The cable tension meter. The wide spacing of the rollers increases accuracy.



The fabric tension meter. Points A, B and C should be in a straight line when the pointer is at maximum reading.

The Crosby Warren tension meters both work on the principle of measuring the sag produced by a spring-loaded plunger bearing on a fixed span of fabric or cable. The cable tension meter may appear a little clumsy, but it does have the advantage over certain other tensiometers that the base is 8in. long compared with 2-3in. The result is that readings are not unduly influenced by differences in cable stiffness as well as cable tension.

Basically the two instruments are alike, but in practice it has been found that the spring in the cable tension meter should be considerably stiffer than that of the fabric meter.

As regards the use of tension meters, since they are both intended for comparative purposes, there is no need to calibrate them in any particular units, and the range can be divided into any convenient numbers. These can be numbered 1, 2, 3, etc. Different cables and different fabric panels are allotted different ranges.

CASTOR SHIMMY

(*Continued from previous page*)

sarily associated with twisting of the whole wheel on the ground in shimmy; therefore the ground damping is increased, but not in a way which prevents a steady taking-up of alignment, as does heavy friction damping at the pivot.

Besides the reduction in the forcing effects, it can be seen that when all the forcing and damping effects are located together (at the contact areas) there will not be the variations in relative intensity already described, which occur between forcing at the contact areas and damping at the castor pivot. Thus shimmy is "nipped in the bud" at the contact areas

Cross-section of a Marstrand-Dunlop anti-shimmy tyre. The outer cover has a tread contour which leaves two ring-shaped ridges in contact with the ground.

Seventy-fifth of the Current Recognition Series

Aircraft Types and

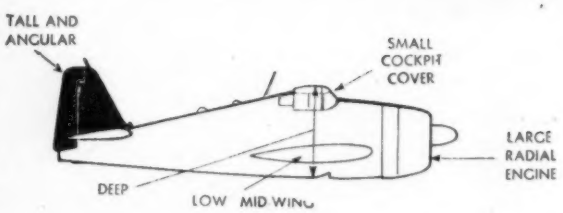
GRUMMAN HELLCAT

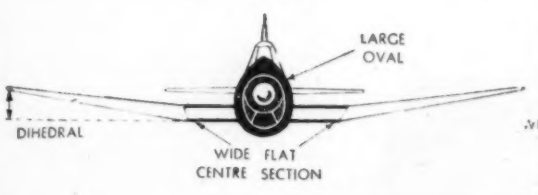
AMERICAN security prevents many interesting data on the new Grumman Hellcat single-seater fighter from being published at the present moment, but it is permitted to describe it in general terms and to point out those features which affect recognition.

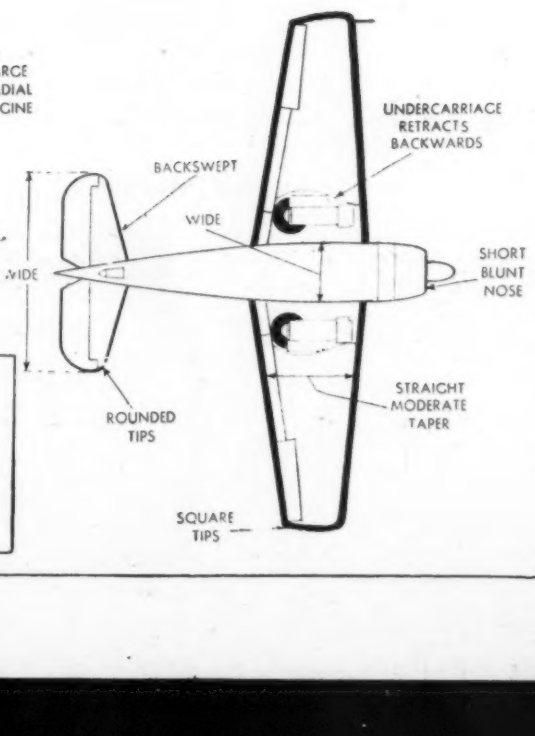
It is obvious from a glance that the Hellcat is a direct development of the Wildcat (or Martlett in the Fleet Air Arm), and in general appearance it resembles it quite closely. The Hellcat is appreciably larger than the Martlet, having a wing-span greater by nearly 5ft., and an approximately equal increase in length. Mere difference in overall dimensions is not in itself a great deal of help in recognition, but there are easily seen differences in design between these superficially similar Grumman fighters which make it quite easy to differentiate between them from any angle.

From a front view it will be seen that the wings of the Hellcat have a fairly wide flat centre-section and are set lower on the "egg"-section fuselage, and that the cowling has a crescent-shaped air-intake below the airscrew hub in the modern style. On the Martlet, however, the mid-wing is set at a dihedral angle from the root, and the cowling of its 900 h.p. Pratt and Whitney Twin Wasp engine is almost circular. In plan view the wings appear identical with those of the Martlet, but the tailplane is different, having half-round elevator tips. Another marked difference is that the undercarriage retracts backwards into the wings instead of being drawn up into the under-belly of the fuselage as on earlier Grumman designs. From the side view the absence of the Martlet's spinal fillet, the higher thrust-line and flatter bottom line of the fuselage are clearly visible.

The Hellcat is powered by a Wright Double Cyclone, but no performance or weight figures may yet be revealed.







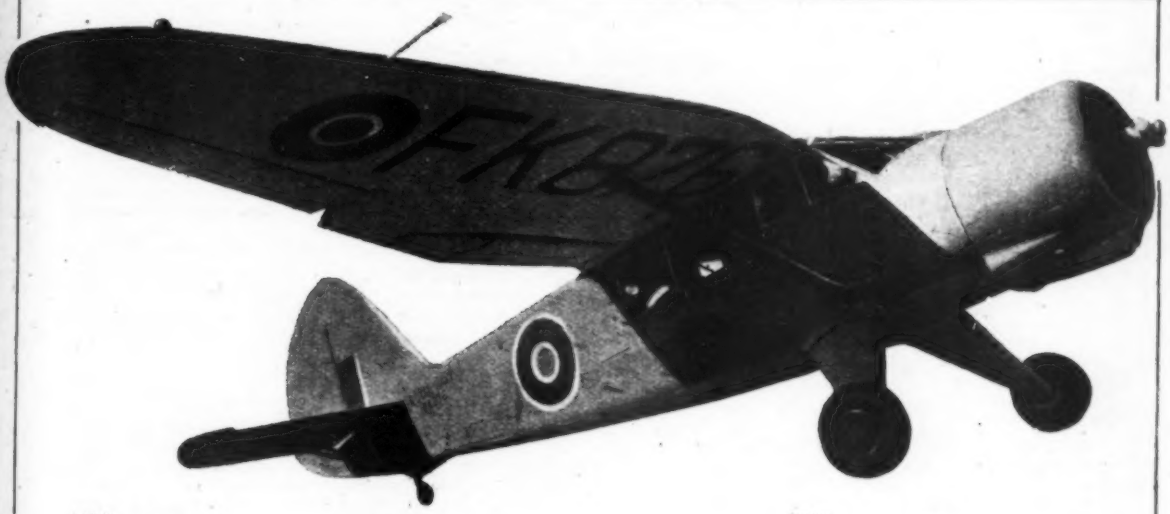
DIMENSIONS

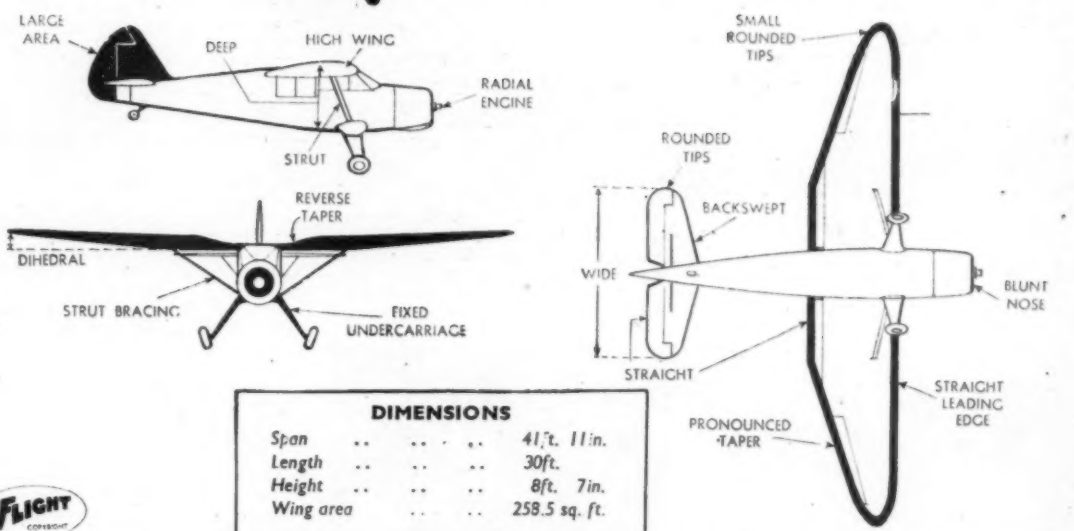
Span	*42ft. 10in.*
Length	*33ft. 7in.*
Height	*13ft. 6in.*
Wing area	*297.6 sq. ft.*

FLIGHT COPYRIGHT

their Characteristics

STINSON RELIANT





DIMENSIONS

Span	*41ft. 11in.*
Length	*30ft.*
Height	*8ft. 7in.*
Wing area	*258.5 sq. ft.*

FLIGHT COPYRIGHT

NOW in service with the Fleet Air Arm as a navigational trainer, the Stinson Reliant (known in the U.S.A.A.F. as the AT-19) earned itself a favourable reputation as a five-seater civil type during the nineteen-thirties. It was always a very nice machine to fly as it had no vices, and its interior arrangements successfully aimed at providing the finish, comfort and atmosphere of a well-appointed saloon motor car. One imagines that the current version of the Reliant, invested with the responsibility of teaching our Naval airmen how to find their way over the unhelpful seas, provides far more Spartan accommodation, but otherwise the aircraft remains substantially the same, except for a somewhat longer nose and a modified tailplane plan.

Wings, fuselage and tail are all welded steel tube structures and fabric-covered except for duralumin sheeting on the leading edge. The eight pre-war civil versions were powered by a variety of radial engines ranging from a 245 h.p. Lycoming to a 450 h.p. Wright Whirlwind or Pratt and Whitney Wasp Junior, but the present Service version has the 290 h.p. Lycoming R-680 air-cooled radial engine. No performance figures have been issued for this model, but its nearest civil equivalent, the SR-10J, which was also powered by a 290 h.p. Lycoming with a two-bladed controllable-pitch airscrew, had a cruising speed of 160 m.p.h. and a service ceiling of 15,000ft.

Although it is some 8ft. shorter in wing-span, the Reliant bears a fairly close resemblance to the Westland Lysander and the two could very easily be confused unless certain revealing differences are appreciated. These include a straight leading edge and single bracing struts, a strut-braced tailplane of much higher aspect-ratio, curved trailing edge to the rudder, comparatively longer and shallower fuselage, and no spats over the wheels.

Behind the Lines

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

Arado

ARADO Ar 196 are said by the Germans to be employed for the protection of naval convoys in the Aegean Sea.

Crashed Jap

THE Japanese *Domei* Agency now reveals that Lt. Gen. Takeshi Sakurada was in an aircraft which met with an accident on September 10th, when on its way to Japan from the Southern regions.

Getting Jumpy

THE formation of a special Paratroop Corps is announced by the Rumanian Secretary of State for Air. An appeal for "the greatest possible" number of volunteers says that physically fit candidates must be of Rumanian "ethnical origin," at least seventeen years of age, and if possible should have knowledge of one foreign language.

Jap Fighters Use Fire Bombs

JAPANESE fighter aircraft are using a new type of bomb in an effort to break up Allied bomber attacks, according to a recent Reuter message from Sydney.

It is a phosphorus incendiary type designed to burst into flaming particles which stick on any aircraft hit and set fire to them.

First news of this missile being used was against Allied bombers attacking the Jap key base at Raboul, and one pilot is said to have likened the effect to "some fantastic Fourth of July celebration."

Bulgaria's Loss

MAJOR-GENERAL KONSTANTIN UDZHUNSKI, of the Bulgarian Air Force, died in Sofia after a severe illness. He was one of the airmen who, after the last war, began to organise the Bulgarian Air Force, and in 1941 he acted as Bulgarian Military and Air Attaché in Rome.

Revival

IN the absence of other cheering news, German propaganda announces periodically a "new" type of aircraft so as to demonstrate the efficiency of the aircraft industry. Much heralded in recent releases is a "new" transport aircraft described as the largest in the world and named the Giant (*Gigant*).

Although the description of this type is, for obvious reasons, rather vague, it seems that the Giant is none other than the Me 323 of African memory.

Two other gliders, the Gotha Go 242 and the DFS 230, receive more than their share of publicity to compensate for the lack of news of other types of aircraft produced.

Many a True Word—

A RARE specimen of the German sense of humour is reported by a Swede recently returned from Germany. Here are two examples, said to be widely circulated all over Germany:—"Hamburg—an etching of Winston Churchill as inspired by Adolf Hitler."

And the other one, a modified version of a High Command Communique: "During last night's raid on Western Germany 69 enemy bombers were shot down. One of our fighters has failed to return, and one of our towns is missing."

EBB TIDE: First German picture of the havoc caused by the attack of Lancasters on the Möhne and Eder dams on May 17th. Factories, power stations and whole towns were then deprived of their power supply by the emptying of reservoirs.

Aridity

FROM Helsinki it is reported that in view of the acute shortage of lubricants and German incapacity to help, the Finnish Government is to promote the production of lubricants from tar. The new industry is to be given annual subsidies up to the end of 1948.

Verboten

BECAUSE of the acute shortage of housing, caused by the mass evacuation and flight from bombed areas, the Reich Commissioner for Housing declared the following towns as closed areas: Berlin, Dessau, Dusseldorf, Krefeld, Leverkusen, Magdeburg, Mainz, Munich-Gladbach, Neuss, Remscheid, Rheydt, Solingen, Viersen, Vienna, Wupperthal and Zoppot.

Nobody is allowed to enter these cities except with the permission of an authority.

Forecast

GERMAN air experts are of the opinion, says a neutral correspondent, that the Allies have adopted new tactics and when in future "bad weather" is announced, the reverse will be the case as far as the possibility of air raids is concerned.

In future it must be expected that the British will make use of all cloudy or foggy weather to raid Germany, providing the weather conditions are fit for landing and taking-off at British bases.

Lares

A REPORT published by the Rumanian Airways "Lares" (Liniile Aeriene Romane Exploatate de Stat) states that company operates the following air routes from Bucharest: Cernauti to Chisinau via Yassy, Odessa via Galatz and Constanza, and the Craiova-Timisoara-Arad and Sibiu-Arad services.

The total mileage covered in 1942 by these regular services amounted to 4,470 miles, but the total amount of miles flown by the company's aircraft was considerably higher: in 1941 it amounted to 826,000 miles (450,000 miles civil traffic and 376,000 miles military), and in 1942, 636,000 miles, of which 416,000 miles were civil and 220,000 miles military traffic.

In 1942 the company carried 11,112 civilian and 1,569 military passengers, as compared with 14,479 civilians and 6,644 military personnel carried in 1941.

Since the beginning of the war, "Lares" has been placed under the direction of the Rumanian Air Ministry, and it is stated that the company rendered considerable service in the transport of war material to the East, and the evacuation of wounded from the Russian front. This is illustrated by the increase in mileage covered and by the allocation of freight carried. In 1941 the company transported 340,000 lb. of civil and 810,000 lb. of military freight, and in 1942, 460,000 lb. of civil and 300,000 lb. of military cargo.

The average speed of the aircraft increased from 134 m.p.h. in 1937 to 142 m.p.h. in 1942.

Aircraft Instruments

Part II. Engine and Ancillary Services

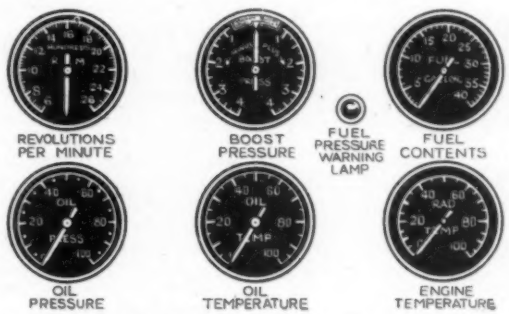
IN the first part of this article which appeared in last week's issue and dealt with the flight instruments (those six instruments grouped on the blind-flying panel) it was mentioned that engine instruments are equally vital; and two in particular, the engine-revolutions indicator and the boost-pressure gauge, are used in conjunction with the flying instruments, whilst the additional engine instruments, which indicate specific conditions of engine operation, are used only indirectly by the pilot and do not concern him objectively with controlling the flight attitude. Nevertheless, engine and ancillary service instruments are indispensable on modern aircraft.

Engine Instruments

The main instruments concerned with the engines are six in number, and although not grouped together on a standardised panel, as are the flight instruments, the engine instruments are usually arranged in close proximity to the flight panel so that they are under the immediate gaze of the pilot.

The engine-revolutions indicator and boost pressure gauge are given pride of place, with the oil-pressure gauge and oil-temperature gauge adjacent. Close to them are mounted the engine-temperature gauge and the fuel-contents gauge with its fuel pressure feed warning light.

Instruments covering the functioning of ancillary services are placed in the most convenient position, the four chief instruments being the flap-incidence indicator, the undercarriage-position indicator, the wheel-brakes, air-pressure gauge, and the oxygen-supply gauge. The latter incorporates two indicators and a regular control in a single casing.

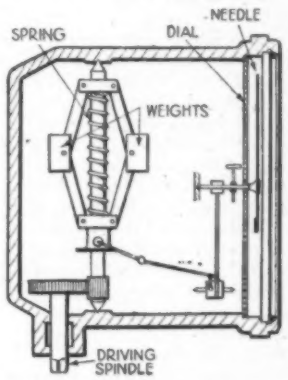


The six cardinal instruments covering the engine operational conditions.

Revolutions Indicator

The R.P.M. Indicator in its simplest form is the centrifugal type. It operates on the same principle as the ordinary car speedometer, and although the latter measures the rate of revolutions of the camshaft or a part of the transmission system, the dial is calibrated in miles per hour. In the aircraft, the pilot needs to know his engine speed in terms of revolutions of the crankshaft per minute, and the instrument dial is calibrated accordingly. The dial scale is figured in increments of two, and the indicated figure has to be multiplied by 100. Thus, when the dial needle points to the figure 16, the engine revs are 1,600 per minute.

Basically, the centrifugal type of instrument consists of a gear wheel driving a small pinion on a governor shaft. The latter has a pair of weights linked to a fixed point at the head of the shaft and to a collar sliding on the lower part of the shaft. A spring between the top fixed point and the collar has a compressional value permitting the weights to move uniformly in relation to the speed of shaft rotation. As the shaft is rotated at increasing speed, the weights move outwards due to centrifugal force,



Diagrammatic section through a centrifugal type Revolutions Indicator.

and in so doing they draw the collar up the shaft against the spring.

A roller bears on the collar, and, according to movement of the latter, imparts motion to the indicating needle through a simple multiplying mechanism. The needle shaft usually carries a hairspring wound to provide sufficient tension to prevent backlash in the multiplying gear and hold the roller firmly against the collar on the governor shaft.

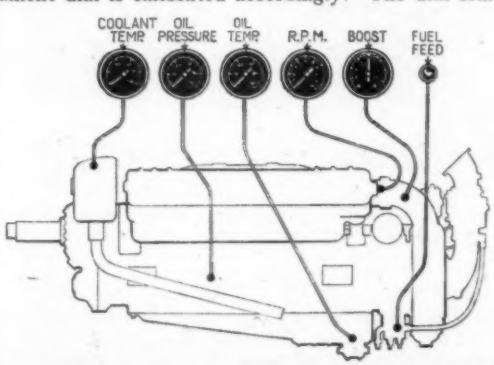
The arrangement of component parts in these instruments varies in different makes, but the general operating principle is common to all. The main disadvantage arises from the necessity of using a flexible shaft to transmit the drive from engine to instrument. Whilst this may present no difficulty in a single-engined aircraft, it assumes serious proportions in the case of multi-engined types where the outboard engines might be 20 feet or more from the cockpit.

Electrical Type

In such cases it is usual to fit an electrical revolutions indicator, which employs a small generator driven by the engine. The generator is connected to the indicating instrument which is really a voltmeter. The dial is, however, graduated in revolutions per minute instead of in volts. The action of the instrument depends on the fact that the voltage produced by the generator is governed by the speed of rotation. This type of instrument is simple and reliable but is not quite so accurate as the centrifugal type, although it is sufficiently accurate for all ordinary purposes.

The Boost-pressure Gauge

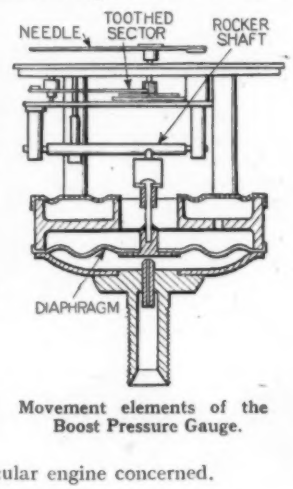
The boost-pressure gauge indicates the pressure in the induction manifold at which the mixture is fed from supercharger to cylinders. It thus provides the pilot with the information necessary for adjusting the power output of the engine for any desired condition of flight; it also



Diagrammatic illustration of engine showing connection reference points for indicators.

enables him to guard against overloading the engine which would otherwise inevitably result in damage.

The gauge is operated by a simple aneroid-type movement, based on the differing pressures inside and outside an airtight diaphragm or capsule. As explained in the article on flight instruments, a capsule is a flat, hollow, circular metal container with concentric corrugations in each of its sides. When subjected to internal or external pressure it is sensitive and readily deformed. The deformation is employed to actuate the indicating needle through a multiplying mechanism, usually consisting of a rocker shaft connected to the capsule and driving a toothed sector which rotates the needle shaft.



Movement elements of the Boost Pressure Gauge.

The interior of the capsule in this instrument is completely exhausted of air, and the case in which the capsule is housed is airtight, with a connecting pipe to the induction manifold. Thus the pressure inside the instrument case is always that of the manifold, and fluctuations in this pressure will cause a corresponding variation in the deformation of the capsule.

The instrument dial is usually marked with either a coloured sector or a lubber line to denote the maximum permissible boost pressure for the particular engine concerned.

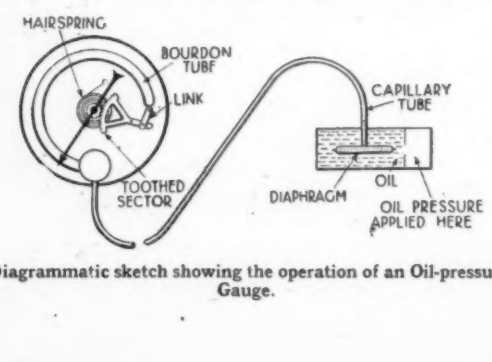
Oil Pressure

The Oil-pressure Gauge is one of the most important engine instruments; it registers the pressure of oil circulating in the engine lubrication system, with its critical influence on optimum operating efficiency.

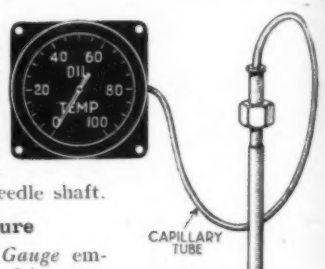
Owing to the fact that the gauge in the cockpit is usually situated at a considerable distance from the engine, a direct connection to convey oil from the lubrication system to the gauge is often impractical; for this reason a capillary line is employed.

The capillary line is a tube of very small bore, which connects into a Bourdon tube, i.e., a curved, flat, rectangular-section tube which has the property of tending to straighten when subjected to internal pressure in excess of external pressure.

One end of the capillary tube is connected into that end of the Bourdon tube which is immovably fixed to the instrument case. The other (closed) end of the Bourdon tube is linked to a toothed sector which is capable of movement. The opposite end of the capillary is connected into the interior of a capsule which is externally subject to engine-oil pressure and housed in a chamber fitted into the lubrication system. The capsule, capillary and Bourdon tube are filled with a suitable liquid. When the capsule is compressed under the engine-oil pressure, the degree of pressure is transmitted via the capillary to the Bourdon and hence to the gauge. The tendency of the Bourdon tube to straighten under internal pressure causes the toothed sector to impart a rotary motion to the indicator needle through the needle-shaft pinion. Backlash is controlled by a hair-spring wound on the needle shaft.



Diagrammatic sketch showing the operation of an Oil-pressure Gauge.



Dial, capillary and bulb of the Oil-temperature Gauge.

Oil Temperature

The Oil-temperature Gauge employs a Bourdon tube and is somewhat similar in operation to the oil-pressure gauge. The Bourdon tube is connected by a capillary line to a thermometer bulb suspended in the engine lubrication system. Mercury in the bulb expands with a rise in temperature of the lubricating oil, and this expansion is communicated through the capillary liquid to the Bourdon tube in the gauge which, in turn, moves the needle over the dial of the gauge through the simple multiplying mechanism.

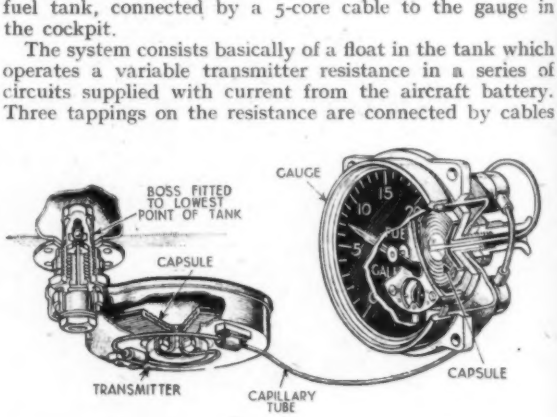
Fuel Contents

The Fuel-contents Gauge on single-engined aircraft is actuated by the weight of fuel carried in the aircraft tanks. In the lowest portion of the tank is a transmitter fitting incorporating a capsule, the interior of which is connected by a capillary tube to another capsule located in the gauge.

Capsules and capillary are filled with a suitable fluid, and the weight of fuel in the tank, compressing the transmitter capsule, causes a proportionate expansion of the gauge capsule. The movement of the gauge capsule is utilised to actuate the indicator needle through a multiplying mechanism.

On multi-engined aircraft an electrically operated fuel contents gauge is usually employed. This type of apparatus incorporates an electric transmitter unit in the fuel tank, connected by a 5-core cable to the gauge in the cockpit.

The system consists basically of a float in the tank which operates a variable transmitter resistance in a series of circuits supplied with current from the aircraft battery. Three tappings on the resistance are connected by cables to three coils in the instrument which, when energised, actuates a permanent magnet connected to the indicating needle.



Perspective section through transmitter unit and indicator mechanism of the Fuel-contents Gauge.

Fuel Warning

The Fuel-feed Warning Light, which is fitted adjacent to the fuel-contents gauge, is lighted when the flow from fuel pump to carburettor is faulty. A line tapping is taken from the feed pipe between pump and carburettor and is connected to a unit incorporating a diaphragm and electric

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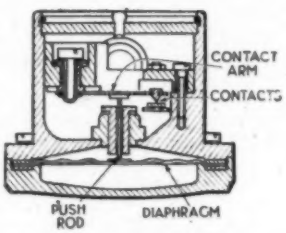
contact points. The contact points are wired up to the aircraft battery and the warning light; they are held apart by pressure under the diaphragm. If, however, the fuel feed is faulty, the drop of pressure in the feed line causes the diaphragm to lower and bring the contact points together, so lighting the warning lamp.

Engine Temperature

Engine-temperature Gauges used for liquid-cooled engines differ from those used on air-cooled engines. Whereas the temperature of a liquid-cooled engine is taken from a point in the coolant circulation system, the temperature of an air-cooled engine is taken from one or more of the cylinder heads. In either case the information is necessary to safeguard against under- or over-cooling of the engine for any particular operative condition.



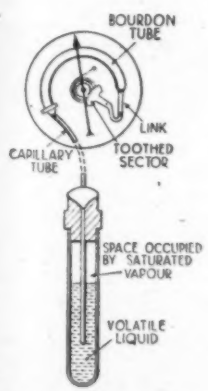
Section showing diaphragm and contact points for Fuel Feed Warning Light.

The temperature gauge for a liquid-cooled engine is operated by a sensitive bulb immersed in the engine-coolant system; the bulb is partially filled with a volatile liquid, the remaining volume being filled with saturated vapour. Immersed in the liquid is the end of a capillary tube (itself filled with liquid), which is connected to the Bourdon tube in the gauge.

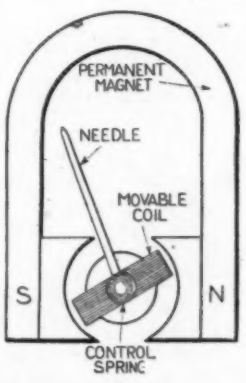
If the engine-coolant temperature rises, the pressure of the saturated vapour increases proportionately, and is transmitted to the gauge through the liquid in the capillary and the Bourdon tube, thus actuating the indicating needle through the usual multiplying mechanism.

On air-cooled engines a thermo-couple incorporating two dissimilar metals (e.g., constantin and copper) is fitted to a suitable part of the cylinder head, and wires are taken from the unit to a milli-volt meter calibrated as a thermometer gauge on the instrument panel. Usually more than one thermo-couple is fitted.

When the thermo-couple is heated, an electromotive force is generated, and the current is passed through a coil of fine wire mounted on a rotatable soft-iron core, between the poles of a permanent magnet in the casing of the thermometer gauge. The coil and iron core are mounted on jewel bearings, and are connected to the indicating needle of the instrument, which moves over the calibrated scale according to the strength of current generated by the thermo-couple.



Radiator thermometer and indicator movement for liquid-cooled engines.



Indicator element for thermo-couple cylinder-head temperature gauge.

Ancillary Service Instruments

Flap Indicator

The Flap Incidence Indicator gives an accurate definition of the precise position of the flaps. Consequently it is of considerable importance to the pilot during the approach and landing. In small aircraft a simple, mechanically operated indicator may suffice, but in large aircraft, where the cockpit may be situated at some distance from the flaps, a mechanically operated indicator is out of the question.

One of the most modern systems for the electrical indication of flap incidence is the Desynn. In this, a small electrical transmitter is fitted at some convenient point on the flap-linkage gear, with wires taken to an electric indicator on the instrument panel.

Current is supplied by the aircraft battery to a transmitter consisting of an arm with two contacts rotating on a ring-type resistance. The arm is connected by links to the flaps, and accordingly moves to whatever position of the flaps is selected. Three wires are taken from tappings on the transmitter to the three coils which energise the ring-type stator of the indicator; rotating within the stator is a pivoted permanent magnet carrying the indicating needle, and according to the position of the arm in the transmitter, the direction and distribution of current to the coils in the indicator turns the permanent magnet to a position relative to that of the transmitter arm, and the needle thus indicates against degrees on the dial the position taken by the flaps.

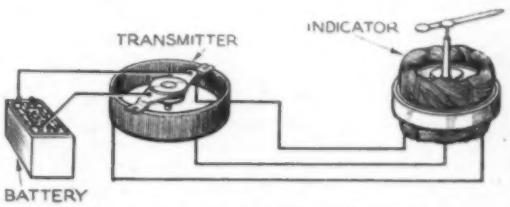
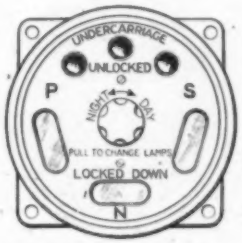


Diagram of the basic elements and connections in the Desynn Flap Incidence Indicator.

Undercarriage

The Undercarriage-Position Indicator is, of course, only fitted to aircraft employing retractable undercarriages, and provides the pilot with positive information as to whether the landing gear is locked safely in the "up" or "down" position.

The indicator usually comprises red and green windows in a dial fitted on the instrument panel. The indicator described has six windows, the upper three being red and the lower three green. Behind these windows are small electric bulbs wired in circuit with the aircraft battery and switches located on the undercarriage legs. The windows on the left-hand side relate to the port undercarriage, while those on the right-hand side are for the starboard undercarriage; top and bottom windows are used where retractable nose and tail wheels are fitted to the aircraft.



Indicator panel for showing safety positions of undercarriage.

When the port and starboard undercarriage legs are safely locked in the "down" position, the windows at each side are illuminated green, but when the undercarriage is being retracted, the upper port and starboard windows are illuminated red, and will continue to be so illuminated

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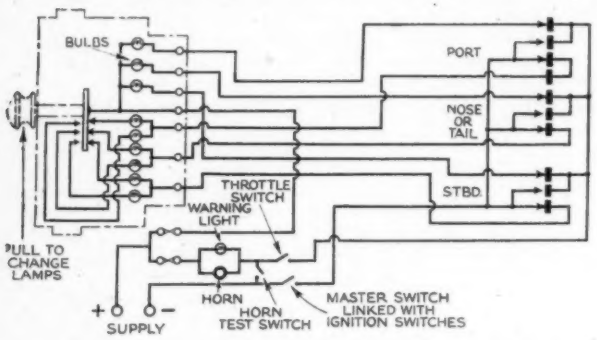
until the undercarriage is retracted safely home and locked, when the red lights disappear.

While the red lights are seen, the pilot will have clear evidence that the undercarriage is in a semi-retracted position, and that it is thus unsafe to land. The diagram illustrates the circuit between the light bulbs, the switches on the undercarriage, and the warning horn which sounds in the



Wiring circuits layout for Undercarriage Position Indicator and Warning Horn.

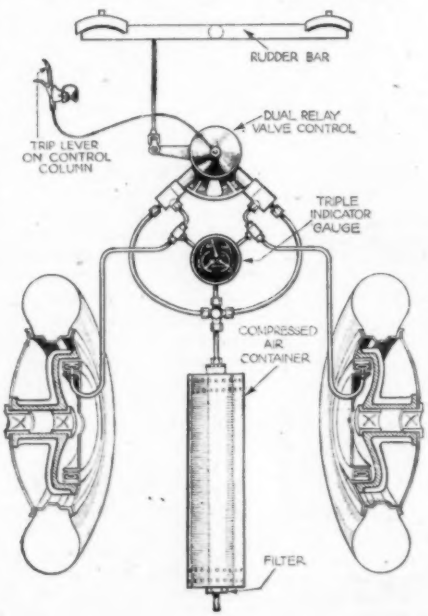
cockpit should the undercarriage be operated incorrectly. Should any of the green lights fail at a vital moment, a knob in the centre of the dial can be pulled to change the electric circuit over to a new set of bulbs. The strength of illumination through the indicator windows can be adjusted for day or night flying by rotating the central knob; in addition to its function for changing over to a new set of bulbs, this knob controls a circular, translucent shade behind the windows which can be brought into use to provide dimming.

Brake Pressure

The Brake-Pressure Gauge registers the available pressure of compressed air in the container as well as the braking pressure applied to each or both wheel brakes.

A single dial, calibrated with three separate scales, is mounted in the cockpit. Indications are given by three separate needles, individually actuated by three Bourdon tubes housed behind the dial.

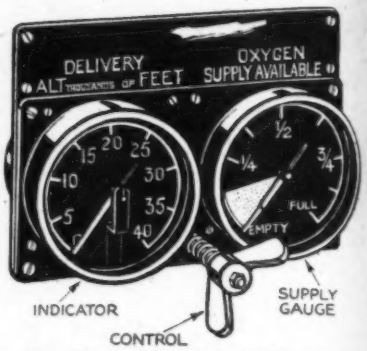
The Bourdon tubes are each connected by pipe-line tappings into the appropriate supply lines between brakes, container and relay control valve, as illustrated in the braking - system diagram.



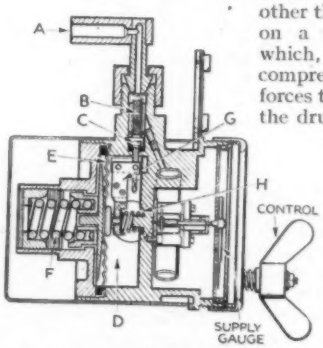
Wheel Brake Pressure supply and application indicator, and (right) the wheel brake system showing connection reference points between container, relay valve, indicator, and brakes.

Although only indirectly concerning the instrument *per se*, a brief explanation of the braking system might be of interest.

The system illustrated is the Dunlop, which enjoys widespread use. The braking elements themselves are of the type commonly known as "internal expanding," the shoes being forced into contact with the brake drum to supply very high frictional resistance to rotation of the wheel. The shoes are located by grooves which prevent any movement other than radial, and are carried on a collapsible rubber tube which, with the introduction of compressed air, swells and so forces the shoes into contact with the drum.



The Oxygen Supply Indicators and Regulator Control fitted on self-contained panel.



Section through Regulator Control showing pressure-reducing valve mechanism.

Differential braking is obtained by the incorporation of a relay control valve linked to the rudder control. This valve, according to the position of the rudder bar, permits a greater volume of air to be supplied to one wheel than to the other, or if the rudder is centralised, to supply each wheel equally.

The air supply from container to relay valve is governed by a trip lever mounted on the control column. Thus the pilot can, by correlating the adjustment of trip lever and rudder bar, control the strength of braking applied and the distribution of the braking effort.

Oxygen Supply

Oxygen-Supply Indicators are incorporated with a regulator control, by means of which the user can adjust the delivery of oxygen according to his needs for the height at which the aircraft is flying. Additionally to this, the pressure of the supply to the individual must be constant, even though the volume is variable, and this constant pressure must be maintained despite drop of pressure in the storage bottles after continuous use.

The small panel carrying the oxygen instruments has one dial indicating the quantity of gas in the bottles. Another registers the correct flow of gas to the face mask for any altitude up to 40,000ft., after the user has suitably manipulated the control screw for the altitude of the aircraft.

An ingenious mechanism is fitted behind this panel for dropping the gas pressure delivered by the bottles down

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to 11-15 lb./sq. in. Referring to the diagram, oxygen from the bottles enters at A and passes the filter B and valve C to the chamber D. One wall of this chamber consists of the diaphragm E, which butts against the strong spring F. A small bell crank lever G is held at its lower end against the diaphragm by a light spring H, and at the upper end is connected to the valve C.

Oxygen under pressure enters the chamber D and forces the diaphragm outwards against the spring F. In doing this it operates the bell crank lever, closes the valve C and cuts off the oxygen feed from the supply at A. As oxygen is drawn off from the chamber D, the pressure in the chamber drops until the diaphragm deflects enough to open valve C and restore the pressure to 11-15 lb. Actually, the diaphragm vibrates at high periodicity, causing the valve to open and close a very small amount at a very high speed, so feeding small quantities of oxygen into the chamber.

Gas from the chamber D passes through the control valve to a small flow-meter operating the altitude/delivery indicator, and thence to the user's oxygen mask.

New 24-Passenger Douglas

First Disclosure of Economical Feeder-line Type Smaller Than DC-3

DOUGLAS AIRCRAFT COMPANY have on their drawing boards a new civil airliner designed to carry 24 passengers, which is said to be of about half the power of the 21-seater Douglas DC-3 airliner and which will cost only about half as much to manufacture.

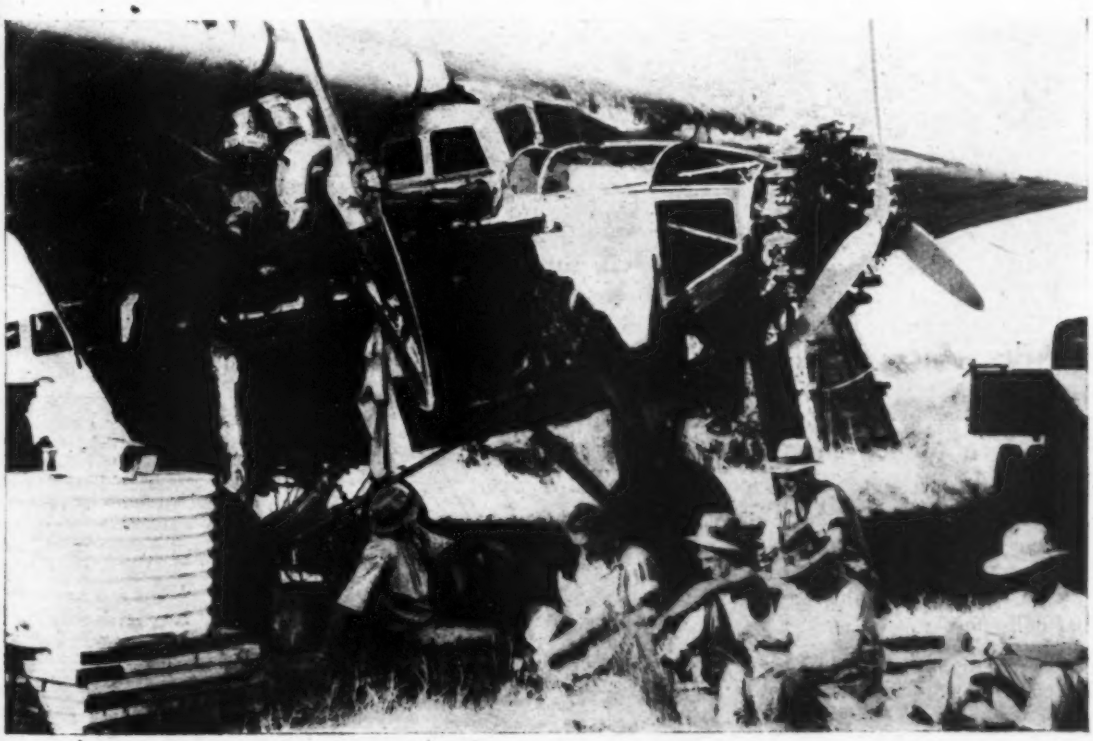
This was revealed by Dr. W. B. Oswald, the Douglas aerodynamicist, during the investigation recently held in Washington by the U.S. Civil Aeronautics Board to ascertain the views of American airline operators and aircraft manufacturers in connection with the development of air services to small cities not served by the main routes. The investigation, which lasted for more than three weeks, became known as the "feeder-pickup hearing," and drew testimony from widely varied groups in the world of American aviation interests.

Dr. Oswald made his disclosure about the new Douglas airliner, which is apparently intended for operation on feeder-line services, in answer to a question from Mr. Edward P. Warner, vice-chairman of C.A.B., on whether he could furnish them with information about the characteristics of post-war aircraft.

Beyond the fact that it was to be a two-engined aircraft of quite conventional appearance but considerably smaller than the DC-3, no further data on the new Douglas was given, but it was revealed that the cost of its operation would be only $36.69 per hour as against $62.03 for the DC-3 type.

"If operating costs are to be kept at a low figure," he is reported as saying, "the length of airfields required in the feeder type of operation is going to be considerably more than the trend in the popular thinking of to-day."

It is understood, however, that Dr. Oswald gave confidential information about the technical improvements which will make possible the construction of the new Douglas when he later met certain members of C.A.B. at a "closed" meeting.



"FAITH IN AUSTRALIA": The Avro Ten which Flt. Lt. Ulm flew from England to Australia in less than seven days in 1933. After evacuating settlers from New Guinea, it now provides shade at a dispersal point on a North Australian airfield.

The Tandem Monoplane

An Answer to the Editor

By T. R. YOUNG

MR. C. M. POULSEN'S interesting article in *Flight* of August 12th makes it relevant to remark that, but for the advent of the war, the tandem monoplane would have been revived, in a hitherto unconceived form, by a prototype of the Warren-Young aircraft, which was covered by British Patent No. 508022 on June 23rd, 1939.

The "gull-wing" tandem of the Scott brothers was almost certainly inspired, as Mr. Poulsen states, by the theory that the weight carried between the two wings would dispense with the "knife-edge balance" of orthodox types; and that this theory was correct was subsequently confirmed by the striking performance of the Peyret tandem glider flown by Maneyrol at the Itford glider meeting of 1922. But despite the very successful flights of the Peyret design, which captured the prize at the meeting, the tandem wing was still thought to be an inefficient arrangement for low-powered aircraft, and thus continued to escape the serious attention of designers.

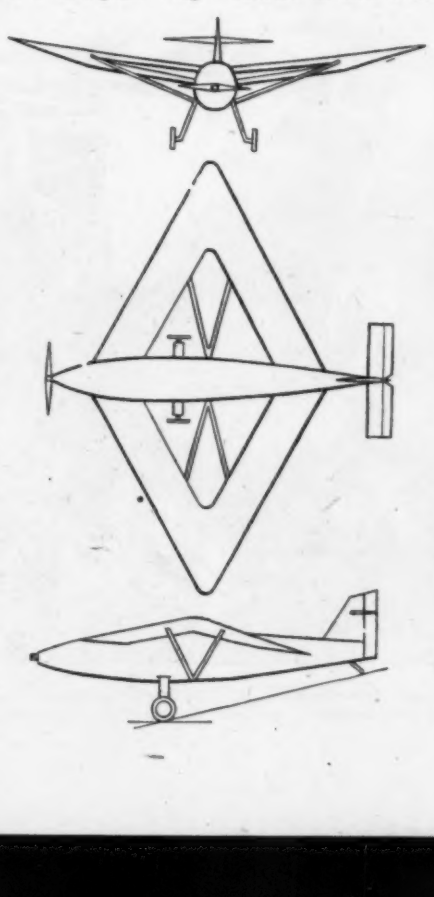
Rhomboidal Ruminations

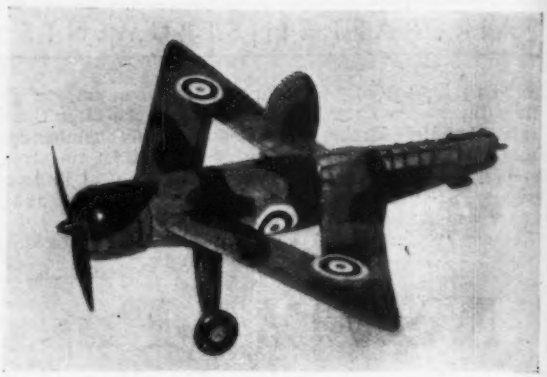
Mr. Poulsen opined that modern aerodynamic knowledge might put a very different complexion on the possibilities of this type, and this opinion is, in fact, convincingly substantiated by the Warren-Young design, details of which, in view of his recent survey, might be of some interest to readers.

In brief, and as is shown by the sketches and model photograph herewith, this aircraft introduces the tandem principle in an original design, that of a triangular wing formation. In the words of the Patent Specification:—

> "In this arrangement the main plane or planes of the orthodox aeroplane are replaced by a system of front and rear planes each converging to merge in a common tip surface. . . The formation of supporting surfaces as described will permit of large angles of incidence being attained in flight without loss of lift; also, by rigging the rear supporting surfaces at a suitable angle of incidence, the front surfaces may be caused to stall before the rear surfaces have attained the critical angle, whence the entire supporting surface can never become completely stalled."

It is contended by the designers that this triangular form endows the tandem principle with many advantages, and, what is equally important, eradicates some of the aerodynamic handicaps inherent in previous tandem types. Among the advantages gained in comparison with orthodox aircraft are: (a) greater wing area for equivalent span; (b) unique disposition of weight owing to position of centre of gravity; (c) elimination of stall owing to restoring moment of rear planes; (d) unusual stability owing to sweep-back of front planes and sweep-forward of rear planes; (the sweep-back of the Dunne aircraft, of notable stability, will doubtless be remembered by many readers);





Rough model of a two-seater fighter with a gun position in the tail.

(e) directional controls incorporated in the "tip surfaces" of the planes, eliminating the customary third control and permitting greater simplicity of piloting. (In the sketches shown a tail assembly is included, but by otherwise providing for directional control the tail assembly can be omitted, for instance, as shown in the picture of the model).

Among the advantages gained over earlier tandem types the following points should be noted: (1) The merging of the two planes into a common "tip surface" permits unique positioning of the control surfaces, which may be installed both in the "tip surface" and/or in the front and rear planes; former directional control and stability problems are thus eliminated. (2) The higher aspect ratio of the planes provided by the common "tip surface" gives obvious aerodynamic advantages otherwise unobtainable. (3) The triangular wing is so designed that the location of the c/g is not critical, and its fore and aft movement can be closely controlled. (4) Owing to the particular application of the lift forces, the distribution of weight may be effected in such a manner as to permit a rear installation for the engine, and frontal accommodation for the passengers, thus making possible a pusher design in its purest form.

Having examined the drawings and specification of the design, Mr. Poulsen has expressed the view that there is some doubt as to whether it comes fully within the range of tandem definition, and that in his opinion it more closely approaches the category of the Cedric Lee annular plane, and the more modern equivalent, the Willoughby Delta.

In tribute to the accuracy of his observations it should be said that both the Cedric Lee specification of 1912 and that of the Willoughby Delta of 1937-38 were, in fact, taken into account when the Warren-Young specification was completed. It can be stated, however, that the careful analysis then made of all three types (precluded by space limitation from the scope of this article) revealed many essential differences, and made it clear that the triangular formation conformed far more closely to tandem principles than to either of the other types.

It is appreciated that the opinion of readers may well prove pleasantly controversial on this point, but, in

THE TANDEM MONOPLANE

brief, it is the designers' contention that the front and rear planes fulfil a purely tandem function, while deriving considerable aerodynamic advantage from the "tip surface" which is common to both planes.

A brief study of the Warren-Young design will, I think, convince the interested reader that it possesses the essentials of an aircraft par excellence for *ab initio* training. Large wing area for small span, ensuring low wing-loading; adequate directional control and stability; in the pusher version, first-class vision from an unobstructed position in the nose; low approach-speed made under positive control, with risk of stalling completely eliminated; in short, a practically foolproof aircraft.

This was, in fact, the aim of its designers from the start, although, in addition, and as Mr. Poulsen has clearly foreseen and remarked in the concluding paragraph of his article, certain military purposes might also be adequately met under tandem principles. An example of this is provided by the photograph submitted, a rough model of a single-engined, two-crew fighter with a gun position in the tail, permitted only by the particular distribution of weight which the design allows.

Although, as has been stated, the advent of war has arrested the further progress of the civilian design, a scale flying model was built and successfully flown in 1939, and gave promise of an interesting performance for the full-scale prototype. Mr. Poulsen has asked: Does the tandem monoplane still have a future? After the war it is hoped that the author and his partner will be able to provide an affirmative answer to this provocative question.

Sixteenth V.C. for the R.A.F.

The King has been graciously pleased to confer the Victoria Cross posthumously on Flt. Sgt. Arthur Louis Aaron, D.F.M., Royal Air Force Volunteer Reserve (No. 218 Squadron), in recognition of most conspicuous bravery.

On the night of 12th August, 1943, Flight Sergeant Aaron was captain and pilot of a Stirling aircraft detailed to attack Turin. When approaching to attack, the bomber received devastating bursts of fire from an enemy fighter. Three engines were hit, the windscreen shattered, the front and rear turrets put out of action and the elevator control damaged, causing the aircraft to become unstable and difficult to control. The navigator was killed and other members of the crew were wounded.

A bullet struck Flight Sergeant Aaron in the face, breaking his jaw and tearing away part of his face. He was also wounded in the lung and his right arm was rendered useless. As he fell forward over the control column, the aircraft dived several thousand feet. Control was regained by the flight engineer at 3,000 feet. Unable to speak, Flight Sergeant Aaron urged the bomb aimer by signs to take over the controls. Course was then set southwards in an endeavour to fly the crippled bomber, with one engine out of action, to Sicily or North Africa.

Flt. Sgt. A. L. Aaron, V.C., D.F.M.

Flight Sergeant Aaron was assisted to the rear of the aircraft and treated with morphia. After resting for some time he rallied and, mindful of his responsibility as captain of aircraft, insisted on returning to the pilot's cockpit, where he was lifted into his seat and had his feet placed on the rudder bar. Twice he made determined attempts to take control and hold the aircraft to its course but his weakness was evident and with difficulty he was persuaded to desist. Though in great pain and suffering from exhaustion, he continued to help by writing directions with his left hand.

Five hours after leaving the target the petrol began to run low, but soon afterwards the flare path at Bone airfield was sighted. Flight Sergeant Aaron summoned his failing strength to direct the bomb aimer in the hazardous task of landing the damaged aircraft in the darkness with undercarriage retracted. Four attempts were made under his direction; at the fifth attempt Flight Sergeant Aaron was so near to collapsing that he had to be restrained by the crew and the landing was completed by the bomb aimer.

Nine hours after landing, Flight Sergeant Aaron died from exhaustion. Had he been content, when grievously wounded, to lie still and conserve his failing strength, he would probably have recovered, but he saw it as his duty to exert himself to the utmost, if necessary with his last breath, to ensure that his aircraft and crew did not fall into enemy hands. In appalling conditions he showed the greatest qualities of courage, determination and leadership, and, though wounded and dying, he set an example of devotion to duty which has seldom been equalled and never surpassed.

During his service with this squadron he had completed 19 operations, most of them against strongly defended targets in Germany, and had 90 operational flying hours recorded in his log-book.

The "Gold Coast" Squadron in which Flt. Sgt. Aaron served flies Short Stirlings. It used to be equipped with Wellingtons.

Retrospect

Two Uses of Air Power : Independent Action and Combined Operations

By MAJOR F. A. de V. ROBERTSON, V.D.

THIS is a month of anniversaries. We have celebrated the anniversary of El Alamein, and the Russians have celebrated the twenty-sixth anniversary of their revolution; so it seems an appropriate time to look back and count up what the British have done in the air during the last twelve months or so.

The salient fact about the Royal Air Force is that (1) it can act independently, (2) that it can help the Royal Navy, and (3) that it can help the Army. These three functions all deserve consideration. Unfortunately, it is difficult to set forth a precise record of what Coastal Command has done to help in the Battle of the Atlantic. Its work goes on incessantly, just as the work of the escort vessels and the Merchant Navy never ceases. Every month it sweeps millions of miles of ocean, and its work, together with that of the sailors, justified the Prime Minister in saying the other day that we have broken the back of the U-boat menace. Everyone rejoiced to hear that one of Coastal Command's pilots has been awarded the Victoria Cross, though, alas! he did not live to wear it.

Apart from this unceasing patrol of the oceans, the Royal Air Force has throughout the year been engaged on two major tasks, differing from each other in location and in character. In each it has worked with the Air Forces of the United States Army, and I hasten to give our brothers-in-arms full credit for their share in the work, though it is the R.A.F. with which this article is chiefly concerned. In the Mediterranean campaign the R.A.F. has been brilliantly assisting the Army, while in what is strategically called the West it has conducted an independent campaign. In the one case it has been helping to win the battles of to-day; in the other it aims to win the battles of to-morrow.

To consider the Mediterranean area first, the most striking point is that there the R.A.F. has learnt *how* to work with the Army. Its success in this art is all the more creditable when we remember the failures of the earlier years of the war. It is not too much to say that in 1939 ideas on the subject were decidedly hazy. The campaign in France is a sorry recollection, and the air side of Gen. Auchinleck's Libyan campaign was not all it might have been. In Great Britain an experiment was made by forming an Army Co-operation Command; but when the methods evolved in Africa had been studied and digested that Command was dissolved and a Tactical Air Force was formed on the African model and placed under Fighter Command.

Mediterranean Organisation

The final organisation in the Mediterranean was curious, but eminently sensible. One A.O.C.-in-C., Air Chief Marshal Sir Arthur Tedder, was placed in charge of all air forces in the inland sea, but was made responsible for carrying out the air side of the plans of Gen. Eisenhower in N.W. Africa and of Gen. Sir Henry Maitland Wilson in the Middle East. Fortunately, these plans are not likely to clash. The N.W. African Air Forces are divided into a Strategic Air Force, a Tactical Air Force and a Coastal Air Force, but during critical battles the Strategical Air Force throws in its heavy bombers to help the Tactical Air Force. This is sound doctrine and sound practice, and we have been assured that when a British expeditionary force again encounters the Germans in the West, not only Fighter Command but also Bomber Command will use every available aircraft to help win the battles of that day.

Tactically, the pattern evolved by Sir Arthur Tedder is, first, to strike at enemy airfields and communications while his fighters ensure command of the air, and then to bomb and shoot-up enemy strong points as the ground troops advance.

For those who like statistics it can be stated that in the last year the Allied air forces in the Mediterranean have dropped nearly 80,000 tons of bombs on Axis targets, have destroyed nearly 7,000 Axis aircraft (about half in the air and half on the ground), and have sunk nearly half a million tons of enemy shipping. On September 14th, the most critical day of the Salerno battle, they made nearly 2,000 sorties and dropped 1,284 tons of bombs in 24 hours on enemy troops and gun positions.

Metropolitan Force

In the West, as has been stated above, Bomber Command, and in a way Fighter Command as well, has been aiming at winning the battles of to-morrow. It has been a year of great increases in every direction for the three Home Commands—which are still sometimes called collectively the Metropolitan Air Force.

To get an adequate idea of the way in which the Metropolitan force has grown we must look back farther than the past twelve months. We all remember what a desperately busy time the Battle of Britain was for Fighter Command. At its height, in September, 1940, that Command made 19,760 sorties, all of them defensive. Defence, one would say, is the primary function of Fighter Command, and aggression can only be a side-line. None the less, in September of this year machines of the Command made over 20,000 sorties, of which more than three-quarters were offensive. In 1940 Göring could never have foreseen such a reversal of fortune as that! He still sends over small numbers of raiders and loses now 6 per cent., now 10 per cent. of them. We, too, send out harassing bodies of Mosquito bombers by night, and in October they lost under 2 per cent. of their number.

While the Battle of Britain was raging, Bomber Command did its plucky best to hit back. But its power was pitifully small. In the three months of May, June and July, 1940, it only dropped an aggregate of 2,800 tons of bombs. German *moral* was not seriously affected—and no wonder! But in the same three months of this year Bomber Command dropped 52,000 tons of bombs. The raid on Coventry destroyed 5 per cent. of the city. By now 40 per cent. of Essen has been virtually destroyed, 54 per cent. of Cologne, and 74 per cent. of Hamburg.

The Germans are a tough race, but these bombing blows have fallen hardest at a time when German armies are meeting with defeats on two fronts, and the saying goes: "Germany is the Army and the Army is Germany." Army defeats break the spirits of the people, and then bombing has its utmost effect on *moral*. Bomber Command has not only shattered many factories but it has disorganised the whole life of industrial areas. The evacuation of millions of people from the stricken towns has placed an immense strain on the overburdened railways. In the effort to restrict the amount of damage the High Command has withdrawn fighter aircraft from the Russian front, leaving the soldiers there without adequate air cover, and this must have assisted the Russians in their advance to no small degree. Yet even though the Russians push on, the Germans cannot leave their production centres undefended—not that the presence in the West of two-thirds of the fighter strength of the *Luftwaffe* has availed to save the cities. Had they been able to concentrate on the Eastern Front, it is calculated that the *Luftwaffe's* strength there might be 2¾ times what it now is.

And now a new threat is emerging from the south, and a force of aircraft has to be mustered from somewhere to meet it. So the German armies have to go short, and on both fighting fronts the Allies hold superiority in the air.

Fighting French in Corsica

French Pilots Fly British Spitfires

(1) A Fighting French pilot adjusts his streamlined "see-behind" mirror while his mechanic gives the Spitfire's windscreen a final polish.

(2) Engine mechanics attend to the needs of the Merlin in a Spitfire V. The overalls and "jockey" caps are an American issue. (3) Corsican partisans armed with British Sten guns patrol the airfield.

(4) An R.A.F. technical officer, on loan to the Fighting French, fills his tank at a portable filling station. (5) A French pilot getting aboard his Spitfire Nine. The wear on the airscrew blade edges is caused by dust sucked up during engine runs.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

TELL THE MAKERS

Sperry Seeks Action Stories

I WONDER if I may trespass upon your space to ask if you could let it be known in your publication that we at this company would be very pleased to hear of any incidents of interest in which our instruments, i.e., the direction indicator, artificial horizon, automatic pilot and others, have proved their worth and been of assistance to the pilots, gunners, etc., concerned.

It is realised that certain of the material may not be releasable owing to the censorship and a lot of it may not be usable until after the war; nevertheless, if photographs and information could be sent to us through the usual R.A.F. channels we should be very pleased to receive them and, naturally, should not disclose anything which did not have full Air Ministry authority.

It is felt that there must be many incidents which will be extremely interesting for the compilation of a history after the war. If you could give this matter some little attention in your publication it would be much appreciated.

J. VIVIAN HOLMAN,
Manager, Aeronautical Department,
The Sperry Gyroscope Company, Limited.

TRIMMING TABS

Why Do They Work?

A SMALL matter which has been confusing me for some time may be elucidated by some of the more erudite readers of *Flight*. It concerns the action of adjustable trimming tabs on control surfaces.

The way I cannot help looking at it makes the result of the tab action of no use. Consider a rudder with the normal trim tab let in the trailing-edge; now, if a certain amount of port rudder bias is required, the trim tab moves to starboard in order to deflect the rudder to port.

The thing that I cannot understand is how a useful or required result is obtained, because, as I see it, the movement of the tab deflects the rudder until the pressure on the port side of the rudder is equal to the pressure on the starboard side of the tab. That being so, the forces are balanced and have no positive action on the obtaining attitude of the aircraft; the only effect is increased drag.

I know that trim tabs are not put on control surfaces for ornament, but I should like to know how they actually do affect the attitude of the machine or the loading of the pilot's controls.

Perhaps some clear-thinking friend might be able to supply the answer.

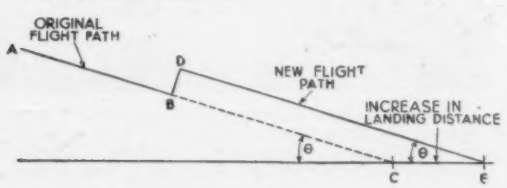
B. B. AND B.

THEORY OF FLIGHT

Jettison to Stretch the Glide

IF "Pilot, R.A.F." wishes to stretch the glide he should jettison. The angle of glide given by the formula $\tan\theta = \frac{D}{L}$ assumes equilibrium of the forces of gravity and air flow. Jettisoning temporarily disturbs this equilibrium. Owing to inertia, the aircraft will continue to fly momentarily at its original speed and, since the angle of attack remains unaltered, the aerodynamic reaction retains its original value. Since weight has been reduced there is a resultant upwards accelerating force, and the aircraft climbs. During the climb speed is lost until weight and aerodynamic force are once more balanced, when the aircraft resumes its glide along a parallel course, as illustrated in the diagram.

Weight jettisoned at B. Aircraft climbs from B to D. Forces in equilibrium at D. Aircraft glides from D to E. All assuming calm conditions.



The effect of lowering flaps is threefold: (a) lift increased; (b) drag increased; (c) c.p. moves backwards, i.e., alteration in trim. Disregarding the last, lowering the flaps 10 deg., as suggested by your correspondent, may result in lift being increased more than drag, in which case the glide would be prolonged.

But why does "Pilot" wonder? Let him test these theories for himself.

"SCOTT-WHITE."

Calculations on Gliding Problems

"PILOT, R.A.F.'s" annoyance at what he calls my glibness is, of course, entirely justified; nobody gets more exasperated than myself by "rules without reasons." I was guilty of the fault in this case because it did not seem that calculations would be of sufficiently general interest, since they give a different quantitative result for each type of aircraft and each set of conditions. In making an analogy with the car instruction book, I had in mind the advice usually given about temporary measures, in case of breakdown, to enable one to reach home or a garage; the cases do appear to me to be parallel in the relevant respect.

I do not, of course, withdraw my criticism of the R.A.F., which was conditional on the correctness of my interpretation of your correspondent's remarks—namely, that he had been given no guidance in the gentle art of gliding as far as possible from a given height. Nobody can consider himself a finished pilot who is ignorant of the subject, although he may soon be finished in another sense! But since it is not feasible to make calculations of this sort in the air, and since the results would, as I have said, be specific to the aircraft and the conditions, an explanation of fundamental principles in the early stages of training should, I suggest, be supplemented by brief verbal or printed advice issued with each operational aircraft. There may be better ways of getting the necessary minimum of information over, but the question should obviously not be wholly neglected.

As "Pilot, R.A.F." does not agree that wind is significant—aerodynamically, I mean—the argument runs thus:—

Let us first agree to define gliding angle as the ratio between height lost and horizontal distance travelled, both relative to the undisturbed atmosphere; this makes it something of an abstraction, but since it is sensibly constant for a given machine and attitude, and is the ratio of C_D to C_L, it seems preferable to the gliding angle relative to the ground, used by one correspondent. The latter is, of course, what we want to discover, though we had better call it "distance travelled from a given height."

Putting the weight equal to the lift, since the flight path is nearly horizontal, we obtain from the ordinary formulae for lift and drag,

$$L = SC_L\tfrac{1}{2}\rho V^2 \text{ and } D = SC_D\tfrac{1}{2}\rho V^2$$

the vertical velocity component

$$V_S = \frac{C_D}{C_L}\sqrt{\frac{W}{SC_L\frac{1}{2}\rho}}$$

and the horizontal velocity component (assuming the wind is entirely horizontal)

$$V_d = \sqrt{\frac{W}{SC_L\tfrac{1}{2}\epsilon}} - V_w$$

where W = all-up weight
V_w = wind speed, relative to the ground and positive for a headwind.
C_L & C_D = lift and drag coefficients respectively.
S = wing area.
ϵ = atmospheric density.

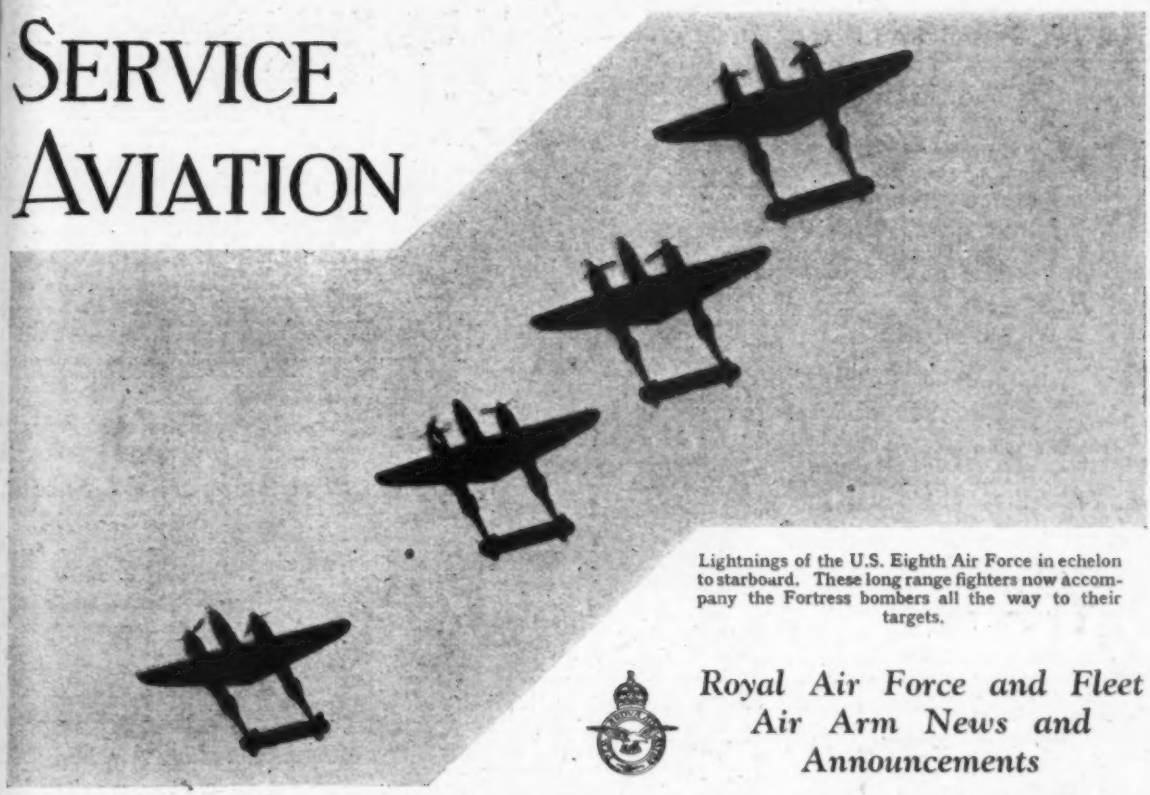
Since speeds are distances per unit of time, V_S/V_D is the distance travelled per unit loss of height, so that the actual distance achieved from an initial height h is

$$d = h\frac{C_L}{C_D}\left(1 - V_w\sqrt{\frac{SC_L\frac{1}{2}\epsilon}{W}}\right)$$

The influence of the main factors is at once evident, except that the best value of C_L (and therefore airspeed) to choose depends on the relation, peculiar to each type, between C_L and C_D. However, to take an extreme case, when the headwind is equal to the airspeed and the expression in brackets vanishes, so that no distance is made good, any reduction in C_L, even at the cost of some increase in drag, will enable *some* ground to be covered. The calculation can, of course, be extended to include the effect of side-winds, if necessary.

W. E. HICK.

SERVICE AVIATION



Lightnings of the U.S. Eighth Air Force in echelon to starboard. These long range fighters now accompany the Fortress bombers all the way to their targets.

Royal Air Force and Fleet Air Arm News and Announcements

Air Aide-de-Camp to the King

AIR COMDRE. G. A. WALKER, D.S.O., D.F.C., has been appointed an Air Aide-de-Camp to the King, and wears the silver letters G.R. on the epaulettes of his aircrew tunic while at work at North of England bomber stations.

Honorary Promotion

GROUP CAPT. W. HELMORE, C.B.E., M.P., R.A.F.V.R., has been granted an honorary commission in the rank of Air Comdre. The new rank now accorded to him is appropriate to the status of the post which he at present occupies in the Ministry of Aircraft Production.

The Air Commodore is the inventor of a number of important war weapons and technical devices which are in wide use throughout the R.A.F. and in the other Services. Amongst these is a special flame trap for preventing fire in the air. He has also played a leading part as a pioneer in the development of searchlights for aircraft; he himself carried out the first flying tests with powerful aircraft searchlights of his own construction as early as February, 1941. Some weeks later these searchlights were employed in active operations against the enemy.

Awards

Royal Air Force

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy:—

Bar to Distinguished Flying Cross

Act. Wing Cdr. W. McF. RUSSELL, D.F.C., R.A.F.O., No. 50 Sqn.—Since the award of the D.F.C. this officer has taken part in a number of raids on objectives in Germany and Italy. He is an outstanding leader and an efficient pilot, whose keenness has materially assisted in maintaining a high standard of achievement among the crews of his squadron.

Act. Sqn. Ldr. A. J. HETWORTH, D.F.C., R.A.F.V.R., No. 12 Sqn.—This officer has continued to operate with unabated enthusiasm since the award of the D.F.C. in January, 1942. He has since completed numerous sorties, and as flight commander has delivered attacks on Hamburg, Essen and other targets in the Ruhr.

Act. Sqn. Ldr. R. E. S. SMITH, D.F.C., R.A.F.V.R., No. 57 Sqn.—Sqn Ldr. Smith, now on his second tour of operational duty, has completed a large number of sorties. These include nine attacks on targets in the Ruhr Valley, three attacks on Hamburg, and one on Peenemunde.

Flt. Lt. H. W. SOUTHGATE, D.F.C., R.A.F.V.R., No. 50 Sqn.—This officer has completed a highly successful tour of operations. In spite of heavy enemy opposition, he has always returned to base with his aircraft undamaged as a result of his skilful airmanship and exceptional efficiency.

Act. Flt. Lt. W. C. LANGSTAFF, D.F.C., R.C.A.F., No. 103 Sqn.—Throughout his two tours of operational duty, this officer has consistently displayed great skill as a navigator. He has taken part in a number of sorties since the award of the D.F.C., invariably displaying courage and ability. On his second tour he has navigated his aircraft accurately to the primary target on every sortie.

Act. Flt. Lt. T. W. LEWIS, D.F.C., R.C.A.F., No. 83 Sqn.—This officer has taken part in a large number of operational sorties. A very efficient bomb aimer, he has always shown great skill in map reading, and on many occasions has successfully aided his pilot in evading heavy concentrations of anti-aircraft fire and searchlights.

Sqn. Ldr. R. F. Hamlyn who has been awarded the A.F.C. for Air/Sea rescue work. He won the D.F.M. as a sergeant pilot in the Battle of Britain.

Act. Sqn. Ldr. H. F. O'NEILL, D.F.C., R.A.F.O., No. 1435 Sqn.—Since the award of the D.F.C. this officer has led his squadron, and on several occasions his wing, with great success. In March, 1943, he led the squadron in a low-level attack on a factory in Sicily, which was effectively bombed. In June, 1943, Sqn. Ldr. O'Neill took part in a number of fighter-bomber attacks on targets in Sicily. In addition, he attacked and damaged a tank-landing craft and a schooner off Syracuse. His operational flying has included shipping strikes, fighter-bomber raids, and intruder sorties. He has destroyed two enemy aircraft and damaged others.

Distinguished Flying Cross

Act. Sqn. Ldr. J. D. SNIDER, R.C.A.F., No. 419 (R.C.A.F.) Sqn.
Act. Sqn. Ldr. D. C. WELLBURN, R.A.F.O., No. 61 Sqn.
Act. Sqn. Ldr. R. E. YOUNG, R.A.F., No. 156 Sqn.
Flt. Lt. J. A. BRECKELL, R.A.F.V.R., No. 9 Sqn.
Flt. Lt. L. V. HARCOURT, R.A.F., No. 7 Sqn.
Flt. Lt. G. HIPKIN, R.A.F.V.R., No. 90 Sqn.
Flt. Lt. G. F. ROBERTSON, R.A.F.V.R., No. 9 Sqn.
Flt. Lt. W. A. SCRYMGEOUR-WEDDERBURN, R.A.F., No. 101 Sqn.
Act. Sqn. Ldr. A. F. WALLACE, R.A.F., No. 620 Sqn.
Flt. Lt. J. R. WOOD, R.A.F., No. 10 Sqn.
Capt. D. J. MAREE, S.A.A.F., No. 60 Sqn.
Act. Flt. Lt. J. W. ARMITAGE, R.A.F.V.R., No. 35 Sqn.
Act. Flt. Lt. K. T. BALDING, R.A.A.F., No. 218 Sqn.
Act. Flt. Lt. R. G. BECKER, R.A.F.V.R., No. 76 Sqn.
Act. Flt. Lt. W. C. T. BRAY, R.A.F.V.R., No. 207 Sqn.
Act. Flt. Lt. R. H. BROOKBANKS, R.N.Z.A.F., No. 10 Sqn.
Act. Flt. Lt. W. T. BROWN, R.N.Z.A.F., No. 158 Sqn.

Conspicuous Gallantry Medal (Flying)

Flt. Sgt. A. W. J. LARDEN, R.C.A.F., No. 218 Sqn.—For citation see Flt. Sgt. AARON, V.C., D.F.M., on page 565.

Distinguished Flying Medal

Sgt. T. GUY and Sgt. M. M. MITCHEM, both of No. 218 Sqn.—For citation see Flt. Sgt. AARON, V.C., D.F.M., on page 565.
Flt. Sgt. F. CLAYTON, R.A.F.
Flt. Sgt. D. L. COEN, R.A.A.F., No. 83 Sqn
Flt. Sgt. J. A. COOK, R.A.F.V.R., No. 83 Sqn.
Flt. Sgt. A. J. CORK, R.A.F.V.R., No. 50 Sqn.
Flt. Sgt. W. D. J. CRAIG, R.C.A.F., No. 35 Sqn.
Flt. Sgt. W. J. DE BOIS, R.A.F.V.R., No. 226 Sqn.
Flt. Sgt. G. G. DOCKENDORFF, R.C.A.F., No. 76 Sqn.
Flt. Sgt. B. DUFF, R.A.F.V.R., No. 101 Sqn.
Flt. Sgt. J. C. E. DUNCAN, R.A.F.V.R., No. 248 Sqn.

SERVICE AVIATION

Flt. Sgt. J. H. EVANS, R.C.A.F., No. 426 (R.C.A.F.) Sqn.
Flt. Sgt. G. N. FELTHAM, R.A.F.V.R., No. 106 Sqn.
Flt. Sgt. J. GINGLES, R.A.F.V.R., No. 432 (R.C.A.F.) Sqn.
Flt. Sgt. T. S. HEYES, R.A.F., No. 429 (R.C.A.F.) Sqn.
Flt. Sgt. G. B. HOMEWOOD, R.A.F.V.R., No. 44 Sqn.
Flt. Sgt. G. V. JOHNSON, R.A.F., No. 100 Sqn.
Flt. Sgt. W. F. KNOTT, R.A.F.V.R., No. 10 Sqn.
Flt. Sgt. G. H. LANCASTER, R.C.A.F., No. 61 Sqn.
Flt. Sgt. J. E. BURTON, R.A.F., No. 199 Sqn.
Flt. Sgt. G. M. CHRISTIE, R.A.F.V.R., No. 106 Sqn.
Sgt. N. BUTTS, R.C.A.F., No. 196 Sqn.
Sgt. T. CALVERT, R.A.F.V.R., No 101 Sqn.
Flt. Sgt. J. F. SMITH, R.C.A.F., No 21 Sqn.
Sgt. H. MEHMED, R.A.F.V.R., No. 55 Sqn.

THE KING has been graciously pleased to approve the following award in recognition of gallant and distinguished service :—

Military Cross

P/O H. R. CARMICHAEL, R.A.F.

Award of a Foreign Decoration

THE KING has granted unrestricted permission for the wearing of the undermentioned decoration conferred on the officers and airman indicated, in recognition of valuable services rendered in connection with the war :—

Conferred by the President of the United States of America

Air Medal

Flt. Lt. R. S. DUNCAN, R.N.Z.A.F.
Flt. Lt. D. A. GREIG, R.N.Z.A.F.
Flt. Sgt. R. A. MARTIN, R.N.Z.A.F.

Fleet Air Arm

THE KING has been graciously pleased to approve the following award :—

For great keenness and enterprise in air operations in the Mediterranean :

Mention in Despatches

Temp. Ldg. Airman L. E. BOYLETT.

Roll of Honour

Casualty Communiqué No. 306.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list, 120 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. F. R. Rowen; Sgt. A. C. Thewlis.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. A. M. Boam; Sgt. J. H. Brooks; Flt. Sgt. C. T. Clifton; Sgt. D. Collins; P/O. C. P. F. Cronin; Sgt. G. H. Evans; Act. Flt. Sgt. F. Fairhurst; Flt. Sgt. R. R. Feeley; Flt. Sgt. T. R. Furness; Sgt. G. R. Gilbert; Sgt. R. B. P. H. Heath; Sgt. J. M. Iliff; Act. W/O. H. A. S. Jeffries; Sgt. P. P. Jobling; Flt. Sgt. W. Leak; F/O. J. McCartney; Sgt. J. H. McKenna; P/O. J. Millward; Sgt. C. M. Page; Sgt. F. R. Regan; Sgt. J. H. Ross; F/O. F. A. M. Shooter; Sgt. W. H. Swire; Sgt. W. Watts; Cpl. E. J. W. Wheeler.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. E. R. V. Ashcroft; Sgt. R. F. Bannister; Flt. Sgt. F. H. Baron; Flt. Sgt. J. Bartley; F/O. I. C. Burns; Sgt. J. E. Callaghan; Sgt. S. F. W. Chappell; Sgt. J. G. B. Chilvers; Act. Flt. Lt. W. Docherty; Wing Cdr. H. D. Fraser, O.B.E.; Sgt. A. H. Fry; Sgt. S. J. Goff; P/O. W. Goulding; F/O. R. S. Griffin; Sgt. C. J. Grimshaw; Sgt. R. Hart; Sgt. J. S. Hunter; Sgt. H. Jenkinson; Sgt. T. W. Jones; F/O. R. L. King; Sgt. M. H. Knowles; Sqn. Ldr. B. J. E. Lane, D.F.C.; Flt. Sgt. V. G. Lawrence; Sgt. G. W. Lewis; Sgt. A. McCabe; Sgt. A. Mitchell; Wing Cdr. V. Mitchell, D.F.C.; Sgt. R. J. B. Montigue; Sgt. B. Naylor; Sqn. Ldr. C. O. O'Donoghue; Sgt. G. T. Padden; Flt. Sgt. A. C. W. Parker; W/O. W. J. Payne; W/O. R. W. Pearson; Sgt. E. J. Pete; Sgt. L. H. Richardson; Sgt. A. H. Rider; Flt. Sgt. E. J. Rowe; Sgt. S. Stafford; Sgt. R. S. Sweetlove; Flt. Lt. W. J. H. Tucker; Sgt. J. L. G. Waite; Sgt. J. I. White; Sgt. L. Whiteside; Sgt. J. E. Winn.

WOUNDED OR INJURED IN ACTION.—Sgt. A. C. Clegg; Sgt. L. Tomlinson; Sgt. L. R. Wright.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. F. G. Chapman; Sgt. A. J. Cossins; F/O. F. M. Davison; Sgt. T. C. Edwards; F/O. D. P. Magee; Sgt. E. Whitfield; Sgt. C. Williams.

MISSING.—Sgt. F. Abell; Sgt. E. A. Ancell; Sgt. R. Askwith; F/O. J. Austin; Sgt. F. Bailey; Sgt. D. Barnes; F/O. J. Basten; F/O. J. W. Bewick; Sgt. A. J. Bishop; Flt. Sgt. D. Bishop; Sgt. B. O. L. Boyd; Sgt. P. L. Buck; Sgt. H. E. Buckman; Flt. Sgt. J. Cassidy; Sgt. J. Chalkley; Sgt. G. E. W. Coombs; F/O. J. Coulthard; Sgt. A. Cox; Sgt. J. Curran; W/O. H. E. Curtis; F/O. L. J. De'Ath; Sgt. G. N. Dodds; Sgt. R. Downs; Sgt. F. C. Dryden; Sgt. R. S. Facey; Sgt. C. S. Field; Sqn. Ldr. J. N. Forrest, D.S.O., D.F.C.; P/O. R. M. C. Frencham; Flt. Sgt. R. W. Gollogly; Act. W/O. L. E. F. Green; Sgt. J. F. Hady; Sgt. E. F. Harris; Sgt. D. R. Hempstock; Act. Sqn. Ldr. W. H. B. Hiles, D.S.O., D.F.C.; Sgt. A. E. T. Hill; Sgt. R. Hill; Sgt. P. Holloway; Sgt. N. Hugill; Sgt. S. J. Humphreys; Sgt. W. G. Jennings; Sgt. J. G. Jones; Sgt. S. W. Kent; Sgt. J. B. Kershaw; Sgt. H. E. Kilburn; P/O. E. Kirk; Flt. Sgt. G. W. A. Lambert; Sgt. G. O. Leadbeater; Sgt. F. Lennard; Sgt. A. R. Line; Sgt. G. E. Lloyd; Sgt. E. R. Lowe; Sgt. J. W. Lowe; Sgt. G. A. McArthur; Sgt. O. McCoo; Sgt. L. F. McDermott; Sgt. D. W. McDonald; Sgt. H. Machin; F/O. J. P. Mahoney; Sgt. S. J. Marks; Sgt. R. L. Measor; Flt. Sgt. F. G. Metcalfe; Flt. Sgt. R. A. Moore; Sgt. V. C. Moore; Sgt. E. M. Morgans; Flt. Sgt. F. L. Mortimer; Sgt. W. G. Mycock; Sgt. H. Napier; Flt. Sgt. A. E. G. Nunn; Wing Cdr. P. B. B. Ogilvie, D.S.O., D.F.C.; Sqn. Ldr. E. H. Parrott; F/O. F. E. Phillips; P/O. L. Prendergast; P/O. L. A. Prickett; Sgt. G. A. Purcell; Sgt. T. Pyle; Sgt. W. H. Quance; Sgt. R. F. Roberts; Sgt. K. Robson; P/O. P. J. Ryan; Sgt. P. W. Shale; Flt. Sgt. S. Shaw; Sgt. W. H. Shaw; Sgt. C. G. Taylor; Sgt. H. Taylor; Sgt. G. Thompson; Sgt. R. E. Tomlin; Flt. Sgt. J. Travis; P/O. R. C. Tucker; Sgt. W. Turner; P/O. J. N. Ure; Sgt. D. M. Walder; Flt. Sgt. A. J. Walford; Sgt. N. G. Webb; Sgt. T. N. Weston; P/O. R. A. Winn; P/O. J. E. Woodgate; Sgt. E. B. Woodrow; W/O. M. Woolcot; Flt. Sgt. J. M. Young.

KILLED ON ACTIVE SERVICE.—Sgt. J. F. Avison; Sgt. G. Barsky; L.A/C. W. Groves; P/O. K. F. Oldham; Flt. Lt. H. R. Puplett, D.F.C.; L.A/C. D. J. B. Robbins; F/O. I. F. Stamper; P/O. D. F. Wigley; Sgt. N. H. M. Williams.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. G. Hewitt; Sgt. R. A. Maun.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—W/O. C. C. N. Bailey; Flt. Sgt. D. M. Boon; Sgt. J. G. Cairns; Sgt. J. M. Clarke; Sgt. L. Hodgson; Sqn. Ldr. D. W. S. Ireland; Sgt. R. Paxton; Sgt. W. Ramsey; Sgt. A. Watson.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. R. Cederbaum; Cpl. J. C. R. Elvin; Sgt. J. Egley; F/O. C. A. Faulks; L.A/C. J. R. Hather; Sgt. L. Tomlinson.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. F. A. Cook.

DIED ON ACTIVE SERVICE.—A/C.2 F. G. Barrell; Cpl. G. J. Hardy; A/C.1 B. Hill; A/C.1 J. Laidler; Flt. Sgt. J. T. F. Luscombe; L.A/C. R. Stobbs.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. J. A. Aldersley; F/O. R. C. Hogg; F/O. T. J. J. Lee; Sgt. H. Popplestone; Sgt. C. J. Sinclair.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.1 B. Robertson; L.A/CW. B. H. M. Turner.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. C. E. Tanner.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. T. W. S. Addison; F/O. L. G. Emrys-Jones; Sgt. F. McKendrick; Sgt. L. H. Morton.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. N. Roggenkamp.

MISSING.—Flt. Sgt. W. A. Burgum; P/O. K. Fairlie; P/O. F. D. Findlater; Flt. Sgt. H. C. Harber; Flt. Sgt. B. F. Sedgley.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. M. Borthwick; Flt. Sgt. P. R. Good; Flt. Sgt. S. A. Grant; Flt. Sgt. L. W. Martin; Sgt. R. K. Matthews.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Act. Flt. Lt. R. D. Willsims.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. G. D. Boyer; Sgt. F. R. Burke; Sgt. W. W. Cameron; Flt. Sgt. M. G. Church; F/O. L. M. Clark; P/O. J. A. Dalton; Sgt. R. L. Dickie; Sgt. D. E. Giles; F/O. S. G. Kimmel; F/O. H. N. Kirkland; F/O. J. D. McBride; Sgt. D. A. MacDonald; Sgt. H. A. MacEachen; F/O. J. P. Monckton; Sgt. H. R. Moore; F/O. D. A. Power; Sgt. H. Rands; P/O. E. A. Sirett; P/O. K. R. Smith.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. Anderson; Sgt. J. C. E. Dellar; Flt. Sgt. E. W. J. Gilson; Flt. Sgt. M. L. Roberts; Sgt. A. C. Weir.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. C. A. Goring.

MISSING.—P/O. E. D. Bonin; F/O. J. B. Bowden; Sgt. R. H. Cowley; Flt. Sgt. D. M. De Silva; P/O. R. C. Harding; Sgt. G. R. Harrison; Flt. Sgt. E. M. McArthur; Sgt. D. L. McNichol; P/O. W. Martin; Flt. Sgt. P. Pynisky; P/O. B. H. W. Stevens.

KILLED ON ACTIVE SERVICE.—Sgt. V. E. Attree; Sgt. T. R. T. Hudson-Bell; Sgt. W. E. McDonald; Sgt. W. J. Miller; P/O. G. W. Ritchie.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. V. R. Crane.

DIED ON ACTIVE SERVICE.—Sgt. J. D. Rubinstein.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. J. A. Coughlin.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. C. J. Campbell.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—W/O. T. H. Bagnall; Sgt. J. D. Sclater; P/O. R. C. Smart.

MISSING.—Flt. Sgt. J. G. A. Fisk; P/O. G. V. Helm; Flt. Sgt. E. V. Potter; P/O. R. Rowe; Flt. Sgt. D. M. Stewart.

KILLED ON ACTIVE SERVICE.—P/O. L. M. Rawlings.

Casualty Communiqué No. 307.

Of the names in this list 106 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—F/O. H. W. Baylis; Sgt. C. H. Hilton; Sgt. H. R. Jones; F/O. C. J. Keirl; Sgt. F. Roberts; Sgt. E. B. F. Scorey.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. J. S. Barrow; Flt. Sgt. W. O. Goff; F/O. L. H. Hunt.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. L. E. Austin; Sgt. G. L. Banks; Sgt. S. D. Beadon; Sgt. S. Bell; Sgt. W. A. Bennett; Sgt. H. S. F. Bishell; Sgt. D. G. Blackmore; Sgt. W. A. Blackmore; Sgt. J. J. Blignaut; Flt. Lt. J. M. Bousfield.

The gunner firing the four guns of a rear turret. It is interesting to note the small flash at the muzzles and the multiple line tracer effect.

D.F.C.; Sgt. J. H. Brown; Sgt. W. H. Brunning; Sgt. G. H. G. Collins; Sgt. S. Cooper; Sgt. J. Corke; Sgt. F. G. Crapp; Sgt. A. J. Dabbs; Sgt. P. Davey; P/O. D. J. Downer; F/O. P. M. Dunne; Sgt. B. J. Eckett; Sgt. E. V. Evans; Sgt. E. J. Forward; Sgt. J. D. Goldie; P/O. A. E. Gough; Sgt. A. Hallewell; P/O. G. R. Harvey; Flt. Sgt. J. G. Hebdon; P/O. C. Heywood; Sgt. G. J. Hunt; F/O. J. S. Hustler; P/O. G. E. Johns; Flt. Lt. J. G. Johnston; Flt. Sgt. H. J. Knight; P/O. G. C. Layley; Sgt. D. St. J. Lidiard; Act. Flt. Lt. B. K. Lindsay; Sgt. V. Loar; Sgt. L. S. Lovatt; Sgt. C. S. McHenry; Flt. Sgt. A. A. Mackenzie; Sgt. C. Mackenzie; Sgt. W. R. Maunder; Flt. Lt. J. H. D. Mercer; Sgt. R. P. Moodey; Sgt. F. Morrison; Sgt. W. F. O'Beirne; Sgt. W. J. Oran; Sgt. R. G. C. Owen; Sgt. A. W. Parnell; Sgt. D. B. Pollitt; Sgt. C. H. Pooley; P/O. T. R. Prescott; Sgt. F. H. Saunders; Sgt. S. Scott; Flt. Lt. D. A. Shead; F/O. L. J. Skinner; Sgt. F. Spurr; Sgt. P. J. C. Thomas; F/O. J. B. Thornton; P/O. J. E. Turnham, Flt. Sgt. C. C. Webb; F/O. L. A. West; Act. Sgt. S. White; Sgt. N. Whitehead; Sgt. H. Woodrow; Flt. Sgt. R. Wrigglesworth; Sgt. K. R. J. Young.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. P. F. Jackson.

WOUNDED OR INJURED IN ACTION.—Sgt. J. Greet; Sgt. P. L. White.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. W. J. Brown.

MISSING, BELIEVED KILLED IN ACTION.—Act. Sqn. Ldr. C. Anckstein; P/O. W. B. G. Bonsey; Sgt. J. Bowyer; Flt. Sgt. W. J. Bunting; P/O. W. H. Cross; F/O. A. G. Davies; F/O. J. B. Day; Sgt. H. A. Gordon; Sgt. A. E. E. Gourd; Flt. Sgt. A. I. Mitchell; F/O. H. Smith; Sgt. S. Thorogood; F/O. G. F. Toy; Flt. Lt. R. A. Ullman.

MISSING.—Sgt. W. W. G. Addison; P/O. F. W. Bateman; Sgt. S. G. Bond; P/O. E. J. Brown; Sgt. G. C. Burton; Sgt. M. Butler; Sgt. L. R. Cates; F/O. F. Clough; Sgt. B. S. Coz; Sgt. S. G. Coyne; Sgt. R. H. Crooks; Sgt. E. H. Cuff; Sgt. R. H. Day; Sgt. W. Duncanson; Sgt. A. M. Finfer; Sgt. R. G. Finlay; P/O. A. M. Fitzgerald; Sgt R. G. C. Forbes; Sgt. L. C. Gale; Sgt. H. McN. Gill; Sgt. J. Goodwin; Flt. Lt. W. A. Gorton; F/O. W. V. Gregson; Flt. Sgt. J. R. Griffin; Sgt. K. G. Gunn; Sgt. F. Hodson; P/O. A. Honig, D.F.M.; Sgt. A. Holmes; Sgt. I. Illingworth; Sgt. R. Jones; Sgt. K. Keele; Sgt. J. Kemm; Flt. Sgt. N. Kendall; Sgt. W. A. King; Sgt. W. McGill; Sgt. D. G. Malley; Sgt. M. Meakin; F/O. N. S. Mitchell; Sgt. S. J. Mitchell; Flt. Lt. G. L. Mott; P/O. H. G. P. Mounsey; Flt. Lt. G. Newsham; Flt. Sgt. J. F. Nichols; Sgt. J. C. B. Parkinson; Sgt. A. R. Pearce; F/O. H. A. Penny; Sgt. C. H. Pratt; Sgt. S. Preston; Sgt. L. T. Reynolds; Sgt. E. T. S. Rowbottom; Sgt. P. M. H. Salmond; Sgt. J. Seddon; P/O. R. Steer; Sgt. T. H. Sutton; P/O. F. H. Thacker; Sgt. H. A. Toomey; Sgt. R. V. Wallace; Sgt. J. Watson; Sgt. H. F. Webster; Sgt. P. J. Wenmouth; Sgt. A. H. Whetton; Sgt. E. J. Williams.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. S. Borrill; L.A/C. N. Edwards; F/O. V. B. Field; Sgt. E. Hallas; Flt. Lt. J. M. Inglis; Sgt. E. Mallon; Sgt. D. W. O'Leary; Sgt. J. M. Snowden; Wing Cdr. G. E. Wallace.

KILLED ON ACTIVE SERVICE.—Sgt. W. A. Burgess; F/O. M. D. Cohen; Sgt. H. Coulson; Sgt. M. M. Doyle; F/O. P. R. Duff; Sgt. A. E. Duncan; Sgt. F. Frogson; Sgt. P. T. C. Griffiths; Flt. Lt. R. Hornby, D.F.C.; F/O. R. B. Kitchen; Wing Cdr. C. H. Mitchell; Sgt. G. E. Melvin; Sgt. A. J. Ruffle; Wing Cdr. J. S. Sabine, D.F.C.; Sgt. J. Tullock.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. A. W. Cheyne; F/O. D. Hunter; A/C.2 C. Stone.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. A. M. Giles; Sgt. J. Gilmour; Sgt. J. J. Henderson; Sgt. D. Holmes; Sgt. E. H. Woods.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. W. A. Benton; Sgt. J. S. Garnett; Sgt. H. W. Leigh; Sgt. A. J. Richards; Sgt. F. R. H. Soames.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. G. Harper.

DIED ON ACTIVE SERVICE.—A/C.1 L. Bower; Cpl. W. Brown; L.A/C. K. Clarkson; L.A/C. M. D. Collins; L.A/C. A. E. Cullen; L.A/C. 2 I. Gold; L.A/C. C. J. Lakin; L.A/C. R. Rushforth; L.A/C. C. J. Southwell.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—F/O. G. W. E. Paddock.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. K. Bond; P/O. W. G. Burrows; Flt. Sgt. A. L. McDonald; Sgt. S. J. Matthews; Flt. Sgt. C. McD. Miller; F/O. R. A. Moyle; Sgt. H. F. Muller; Sgt. G. R. Sedger; F/O. K. B. Walter.

MISSING, BELIEVED KILLED IN ACTION.—P/O. K. M. Stewart.

MISSING.—Flt. Sgt. H. C. Elsley; P/O. R. G. Fisher; Flt. Sgt. K. C. French; F/O. H. J. McCulloch; P/O. C. M. Nairn; F/O. J. R. Welch; Flt. Sgt. G. A. Lynch.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. L. J. Power; Flt. Lt. E. R. B. Roberts.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. T. Armstrong; Flt. Sgt. J. F. Flanagan; Sgt. R. G. Lacey; F/O. J. P. McDonell; Flt. Sgt. R. E. Rasmussen; Flt. Sgt. P. Tracey.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. L. Gill.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. F. C. Kearney.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. T. H. Lazenby.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. G. A. McQuillin; Sgt. J. A. Pollock; P/O. R. C. Richards; Sgt. W. J. Sullivan.

MISSING, BELIEVED KILLED IN ACTION.—F/O. F. M. Carter; Sgt. J. T. Hamer; F/O. J. A. MacT. McLeish; Sgt. V. T. Perdue.

MISSING.—Flt. Sgt. G. W. Bower; Sgt. L. J. Brondgeest; Sgt. V. A. F. Cleveland; F/O. E. H. Douglas; P/O. H. J. Dowds; Sgt. W. A. Dunleavy;

Air Vice-Marshal H. N. Wrigley, C.B.E., D.F.C., A.F.C., Air Officer Commanding Royal Australian Air Force.

Sgt. A. J. Fairall; P/O. A. W. Freeman; Sgt. D. H. A. Garland; Sgt. M. F. I. Hill; Flt. Sgt. M. L. McClay; Flt. Sgt. D. C. McKenzie; Sgt. K. D. Murray; Sgt. P. A. Musso; F/O. R. H. Orr; Sgt. J. D. Pigeau; Sgt. R. A. L. Scott; P/O. R. Stewart.

KILLED ON ACTIVE SERVICE.—Sgt. T. R. Armstrong; Sgt. W. T. Cheroptia; Sgt. N. M. Dalton; P/O. W. A. Hobson; P/O. K. N. Laing.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. J. C. McNeill; Sgt. W. H. McQ. Maxwell.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. R. W. Simpson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. J. E. Barton; Sgt. W. E. Hammond; P/O. H. A. Harris; Act. Flt. Lt. S. D. L. Hood.

MISSING.—Flt. Sgt. J. P. Donnelly.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. F. H. Angell.

DIED ON ACTIVE SERVICE.—Flt. Sgt. C. W. Early.

South African Air Force

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—2/Lt. W. G. Cathew; Lt. W. G. Parsons.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Flt. Sgt. K. P. Caine.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Lt. A. E. Ajromowitz.

Casualty Communiqué No. 308.

Of the names in this list, 91 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—F/O. L. F. Chapman; F/O. I. E. Cooke; Sgt. J. T. Eccleston; Sgt. P. A. F. Elliott; F/O. H. D. Ham; Sgt. J. L. Harwood; Sgt. W. Hudson; Flt. Sgt. W. S. D. Lewis; Sgt. A. J. Morgan; Sgt. J. Noar; Sgt. G. G. Payne; Sgt. T. C. Williams.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sqn. Ldr. D. M. Barker; Sgt. H. Brock; Sgt. V. M. Caplin; Sgt. F. G. G. Edwards; Sgt. W. E. Harwood; Flt. Sgt. J. Mead; Sgt. T. F. Millar; Sgt. J. Morgan; Flt. Sgt. J. C. Paton; Sgt. D. W. Perch; Flt. Sgt. F. Salvage; Sgt. H. J. Steel; Sgt. R. W. Walker.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. S. McK. Anderson; Sgt. P. Bailey; Sgt. S. C. Brewer; Sgt. K. O. Court; Sgt. R. A. Damms; Sgt. S. Dixon; Sgt. N. Ellis; Sgt. D. B. Everitt; Sgt. J. G. Faux; Sgt. H. C. Ford; Sgt. J. P. Foster; Sgt. J. E. Francis; P/O. R. Gray; Flt. Sgt. J. E. G. Hancock; Flt. Sgt. E. D. Hillen; Sgt. N. Law; P/O. A. F. Lear; Sgt. L. P. Manning; Flt. Sgt H. G. Martins; F/O. J. M. Myers; Sgt. L. J. Nash; Sgt. E. F. Paul; Sgt. M. A. Pollard; Sgt. S. T. Pollard; P/O. F. S. Potter; Flt. Lt. P. Price; P/O. H. S. Readhead; Sgt. H. Rigby; Sgt. H. Riles; F/O. J. H. Salt; F/O. B. Samuel; Sgt. A. N. Sinclair; P/O. W. Smith; Sgt. W. C. Snook; Sgt. K. Spooner; Sgt. C. E. Thorpe; Sgt. W. A. Timms; Sgt. L. G. Webster; Sgt. F. Whitwell; Sgt. A. M. Willis; Sgt. W. Wilson; F/O. R. J. F. Windsor; Sgt. J. C. Woodward.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. J. W. Weight.

MISSING, BELIEVED KILLED IN ACTION.—F/O. N. T. Fairfax; F/O. G. W. Kelly; P/O. R. J. A. MacLeod.

MISSING.—Sgt. L. Bambridge; Sgt. C. Bardill; Sgt. B. J. Barton; Sgt. W. J. Beggs; Sgt. W. Bennett; Sgt. E. W. Brearley; P/O. D. H. Brook; F/O. W. A. Calder; F/O. J. W. Campbell; Flt. Sgt. L. C. Carrington; Sgt. A. Clarke; P/O. D. Collins; Sgt. N. Corfield; Sgt. C. B. Crumney; Sgt. J. R. Culshaw; Sgt. W. M. Daffell; Sgt. L. W. Davies; P/O. J. H. J. Dix; Act. Flt. Lt. T. R. Dobson; Sgt. V. A. Drayton; Sgt. H. J. Ferret; Sgt J. Findlay; Sgt. D. W. Firth; Flt. Sgt. A. E. Fuller, D.F.M.; Sgt. N. R. Gauntlett; Sgt. F. H. Gould; Flt. Sgt. C. E. Gregory; Sgt. G. Haigh; Sgt. R. W. Harrison; Sgt. A. R. Harrop; Sgt. H. T. Hathaway; Sgt. G. H. Hirst; Sgt. R. D. Holdaway; P/O. H. R. Holloway; Sgt. R. W. Holmes; Flt. Sgt. S. D. Hopkin; P/O. F. E. Impey; Sgt. F. L. Jackson; Sgt. C. H. Jacotine; F/O. G. Jarvis; P/O. G. L. Jenkins; Sgt. H. Jennings; Sgt. D. W. Kemp; Sgt. J. L. Kemp; Sgt. E. Lewis; W/O. J. F. Little; Sgt. G. McDonald; P/O. A. McGregor; P/O. I. F. Merricks; Act. W/O. J. A. C. Newman; Sgt. S. J. Oakley; Sgt. C. F. Painter; Flt. Sgt. J. E. Pendleton; Sgt. L. Rees; Flt. Sgt. R. E. J. Rees; Sgt. R. Renfrew; Sgt. G. Rippingale; Sgt. J. A. Robertson; P/O. H. M. Robinson; Flt. Sgt. J. A. Rodd; Flt. Sgt. V. E. Scuse; Sgt. S. G. Shepherd; Sgt. D. Skinner; Flt. Sgt. H. Smedley; Flt. Sgt. A. R. Smith; Sgt. G. Sprout; F/O. R. H. Stanwell; P/O. G. N. Stephenson; Flt. Sgt. W. Stewart; Sgt. J. C. B. Strong; Sgt. J. Thomas; Flt. Sgt. R. C. White; Sgt. T. W. A. Wilkes; Flt. Sgt. H. I. Willcock; Sqn. Ldr. J. E. Willson, D.F.C.

KILLED ON ACTIVE SERVICE.—Sgt. C. B. Crummey; L.A/C. A. F. Bloxham; F/O. R. A. Buckman; Sgt. S. A. Bussey; Sgt. J. A. Coombs; Sgt. A. L. Culley; Sgt. H. Dean; Sgt. I. G. H. Dodds; Sgt. B. G. Donbavand; Sgt. L. H. Durrant; L.A/C. C. W. C. Ellis; L.A/C. W. F. Fowles; Sgt. S. Gilliland; Flt. Sgt. J. W. Gowans; F/O. W. H. Graham; Sgt. W. Hall; Sgt. W. Harrison; Flt. Sgt. D. M. Higgs; Sgt. A. V. Ingram; W/O. P. G. Jesty; A/C.2 P. W. Johns; P/O. P. N. Jordan; Sgt. A. P. King; Sgt. W. H. Lennards; L.A/C. H. G. Maslin; Flt. Lt. R. Mount; Sgt. I. F. W. Pead; Sgt. D. S. Rastall; L.A/C. F. R. Shorney; Sgt. R. F. Stainsby; P/O. T. N. Stockdale; Sgt. A. C. Strolin; Sgt. J. Taylor; Sgt. L. J. Thorpe; P/O. L. A. Walker; Sgt. G. H. Wheatley; Sgt. V. H. Wigmore; Sgt. J. P. Williams; Sgt. J. Winchester; Sgt. F. G. Wright.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. M. Lupton.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. D. S. Gallimore; F/O. J. R. Woolland.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. P. L. Briten; Sgt. L. J. Crosby; F/O. C. S. Humberstone; Sgt. R. H. McArthur; Sgt. J. B. Manning; Flt. Lt. P. Wyatt-Smith.

DIED ON ACTIVE SERVICE.—L.A/C. P. H. Blamied; L.A/C. D. C. Bryson; Flt. Sgt. E. C. M. Eaton; Flt. Sgt. F. Ridge.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. P. C. Andrews; Sgt. G. C. Bird; Sgt. F. W. A. Brice; Sgt. G. A. Burdett; Sgt. J. Davidson; Sgt. R. C. Drinkwater; Sgt. A. G. Endicott; Sgt. W. R. Fairey; Sgt. G. A. Freeman; Sgt. W. G. Greaves; Sgt. S. Groom; Flt. Sgt. R. T. Hall; F/O. S. E. Harris; Sgt. J. W. Henderson; Sgt. J. Hills; Sgt. H. E. J. Horton; Sgt. L. G. Ledamun; Sgt. R. M. Stone; Sgt. J. W. Walsh; Sgt. D. H. Warburton.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.1 B. V. Lothian.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. W. E. J. Austin; Sgt. F. L. Boyd; Flt. Sgt. E. A. Day; P/O. T. L. Gibson; Sgt. R. W. Webber; Sgt. D. G. Williams; P/O. J. C. H. Young.

MISSING.—P/O. J. Y. Clarke; F/O. W. J. Dowling; Flt. Sgt. H. G. Ellis; F/O. D. T. Galt, D.F.C.; W/O. R. M. Goode; F/O. J. C. Grainger; Flt. Sgt. A. Lane; Flt. Sgt. C. D. L. Longson; W/O. H. A. Miller; P/O. T. R. Odgers; Flt. Sgt. K. B. Phillips; F/O. K. M. Simpson, D.F.C.; Flt. Sgt. P. K. Turner; Sgt. L. S. Watson.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. P. C. Bartle; Sgt. H. P. Henry.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. T. B. Richards.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—F/O. P. Kingsford Smith.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. T. D. McCann.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. A. Mitchell.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. M. R. Ledgett.

MISSING.—Sgt. M. Bailey; W/O. D. Betts; Sgt. N. C. Brown; Flt. Sgt. D. J. Cameron; Sgt. F. T. Cooper; P/O. W. J. Dumaday; P/O. L. A. Isfeld; Sgt. J. Jensky; F/O. P. H. W. Johnston; Sgt.

Left to right: No. 46 Squadron "We rise to conquer." No. 47 Squadron "Nili nomen roboris omen." (The name of Nile is an omen of our strength). No. 59 Squadron "Ab uno disce omnes." (From one learn all). No. 142 Squadron "Determination."

SERVICE AVIATION

J. A. B. Kidd; Sgt. H. F. Maughan; P/O. E. G. More; P/O. C. O. Motherall; Sgt. C. F. Pick; Sgt. R. B. J. Pierce; Sgt. D. Ross; Flt. Sgt. T. F. Thould; W/O. B. Winter.

KILLED ON ACTIVE SERVICE.—Sgt. F. E. Adams; Sgt. D. G. D. Burnside; Sgt. J. W. Chester; Sgt. B. E. Clark; A/C.1 D. W. Davies; F/O. J. L. Darby; Sgt. R. L. Henry; Cpl. W. P. Holt; Sgt. G. A. Innes; P/O. S. Josephson; Cpl. J. E. Keighan; Sgt. A. R. J. Le Page; W/O. G. L. Seward; Sgt. K. G. Soutar; Sgt. E. H. Weeks; Cpl. A. E. Woolhouse.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. E. H. Caldwell.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—F/O. A. Kingsley.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. G. H. Wunsch.

MISSING.—Sgt. F. N. Bowler; Flt. Sgt. C. J. Bridiger; Flt. Sgt. F. D. Higham; Flt. Sgt. B. T. E. Parker.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. G. Braddock; Sgt. A. F. Smith.

South African Air Force

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. E. J. Buchler.

KILLED ON ACTIVE SERVICE.—Capt. J. A. Sumner.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Lt. Col. M. E. Whitaker.

DIED ON ACTIVE SERVICE.—Act. Cpl. G. E. Street.

Casualty Communiqué No. 309.

Of the names in this list 112 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. D. G. Brock; Sgt. H. Jack; Flt. Sgt. C. E. Jollands; Sgt. C. Kendrew; Sgt. C. F. Nordhoff; Sgt. G. S. Pawson; P/O. T. W. A. Saxby.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. W. R. Fisher; Flt. Sgt. A. Haddon; Flt. Sgt. G. A. Lindsay.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. P. R. Ackernley; Sgt. J. C. Adam; Sgt. A. G. Allen; Sgt. G. Amos; Sgt. G. C. Baker; Sgt. K. Batson; Flt. Sgt. S. Baxter; P/O. E. Bradley; Sgt. J. C. Brittain; P/O. I. J. D. Brodie; W/O. R. C. Brown; Sgt. G. J. M. Cantwell; P/O. W. H. Cappleman, D.F.M.; P/O. A. Carr; Sgt. J. F. Christon; Sqn. Ldr. W. Clarke; Sgt. W. J. Cole; Sqn. Ldr. R. T. Collier; Sgt. F. R. Collins; Sgt. H. Cowan; Sgt. C. Davies; P/O. A. R. Dicker; Sgt. A. G. Ennis; Sgt. P. Evans; Sgt. N. Frater; Sgt. A. George; P/O. G. B. Gibson; Flt. Sgt. J. Goldney; F/O. F. D. W. Greatrex; Sgt. C. C. Greenaway; F/O. G. B. D. Greenwood; Sgt. J. E. L. Griffiths; Sgt. A. S. Grove; Sgt. D. W. J. Hanson; Sgt. W. G. Harris; Act. Sqn. Ldr. J. Hobbs; Sgt. D. W. Howard; Sgt. G. Hughes; F/O. G. S. Jeffreys, D.F.C.; Sgt. G. E. Johnson; Sgt. J. E. Jones; Sgt. H. R. Kinder; Sgt. F. T. Lax; P/O. J. L. Leigh; Sgt. D. Lewis; P/O. S. C. McLellan; P/O. P. W. Masters; Sgt. C. Murray; F/O. D. J. Murray; Flt. Lt. P. J. Nankivell; F/O. P. B. Nanton; Sgt. C. J. Osborne; P/O. J. G. D. McC. Rawden; Sgt. A. E. Rew; Sgt. T. W. E. Robson; Sgt. P. G. E. Ross; Flt. Sgt. P. A. J. Rudkin; Flt. Lt. C. J. Simmonds; Sgt. H. A. Smith; P/O. H. B. Smith; P/O. J. F. Spencer; Flt. Sgt. A. Taylor; Sgt. J. W. Urquhart; Sgt. S. G. Vials; Sgt. J. B. Wallis; F/O. C. A. Watts; Flt. Sgt. G. E. Watts; F/O. J. Williams; Flt. Sgt. J. Wood; Sgt. J. G. Wyatt.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—P/O. J. A. Hawes; Act. Flt. Lt. W. G. Walker.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. L. J. A. McKenzie.

MISSING, BELIEVED KILLED IN ACTION.—W/O. H. Anderson; Sgt. A. R. Baxter; Sgt. N. J. Calcraft; Sgt. T. R. Crowther; Sgt. J. Curson; Sgt. C. B. Edwards; Sgt. W. H. Evans; Sgt. V. G. Green; Flt. Sgt. T. K. Jones; F/O. P. A. Levy; Sgt. W. S. Lynn; Sgt. S. MacDonald; Sgt. J. L. Oldershaw; Flt. Sgt. A. D. W. Parsons; F/O. J. M. Rankin, D.F.C.; P/O. J. Saxon; Flt. Sgt. W. D. Sparks; Sgt. P. F. Stanley; Sgt. G. L. Terry; Sgt. A. L. Thomas; Sgt. W. C. M. Thomas; F/O. A. Wallace; Flt. Sgt. W. I. L. Wilkes; Sgt. O. W. Wood.

MISSING.—Act. W/O. C. W. Annis; W/O. L. W. Aspden; Sgt. M. S. Baras; F/O. C. L. Barbezat; Sgt. G. H. R. Bell; Sgt. K. J. Bevis; Sgt. H. Butler; P/O. J. I. F. Byrne; Sgt. N. A. P. Chew; Sgt. R. A. Chorley; P/O. W. H. Clague; Sgt. A. B. Clark; Sgt. J. G. Clarke; Sgt. E. W. Clayton; F/O. H. K. Coates; Sgt. E. Colbert; Sgt. R. G. Collins; Sgt. G. V. Cook, Sgt. J. Cooper; Sgt. P. J. Crummey; Sgt. V. A. Deacock; Sgt. R. W. Dobbins; P/O. R. R. F. Durne; Sgt. W. H. Durne; Sgt. F. Eeles; Sgt. R. H. G. Ellis; Sgt. H. E. Elphick; Sgt. W. D. Evans; Sgt. L. J. G. Field; P/O. J. Fletcher; Sgt. A. R. Fraser; Sgt. D. A. Galloway; Sgt. D. Goulden; Sgt. A. H. Green; Sgt. A. H. Greenwood; Sgt. D. Grout; Flt. Sgt. G. E. Hall; Sgt. A. W. Hallworth; Sgt. W. C. Havercroft; Sgt. C. Hayhurst; Sgt. J. J. V. Heal; Sgt. S. G. Hipperson; Sgt. P. R. Hogan; Sgt. C. C. Holden; Sgt. R. Hughes; Sgt. C. Hunt; Act. Sqn. Ldr. I. McA. Huntley-Wood, D.F.C.; W/O. J. R. Hurst; Sgt. P. H. Johnson; Flt. Sgt. W. B. Julian; F/O. G. King; Sgt. K. Knaggs; F/O. K. J. Knight; Flt. Sgt. R. Lawson; Sgt. L. M. Lewis; P/O. A. J. E. Long; P/O. G. F. Lorne; F/O. G. R. McCleave; Sgt. G. McGregor; Act. Group Capt. A. F. McKenna; Flt. Sgt. I. N. McLaren; F/O. R. J. Massie; Sgt. R. P. N. Mullarky; Sgt. R. E. Olive; Sgt. O. J. Overington; Sgt. F. D. Paddon; Sgt. K. Pearson; Sgt. A. Phethean; Flt. Sgt. C. Phillips; Sgt. H. P. Purdy; Sgt. E. Pursell; Sgt. H. R. J. Richardson; Sgt. J. A. Robb; Sgt. P. Roberts; Sgt. J. G. Sacre; Sgt. E. K. Sears; Sgt. K. W. Sedman; Sgt. L. H. Sefton; Sgt. M. J. Selby; Sgt. W. Simpson; Sgt. J. T. Smith; Flt. Sgt. E. G. A. Sotheron-Escourt; Sgt. W. A. Southwell; Flt. Sgt. G. S. Steer; Sgt. A. Tasker; Flt. Sgt. W. H. Thompson; Sgt. J. E. Ward; Sgt. J. A. Whetton; Flt. Sgt. A. J. C. Whitehead; F/O. R. J. Widdecombe; Sgt. F. Willett; Sgt. H. G. Williams; Sgt. L. G. Williams; Sgt. S. J. Wilson; F/O. J. L. Young, D.F.M.

KILLED ON ACTIVE SERVICE.—Sgt. D. S. Audley; Sgt. R. P. Belsey; L.A/C. H. W. Cole; F/O. A. B. Eades; Sgt. J. A. Fairhurst; Sgt. S. A. Gawler, D.F.M.; Flt. Sgt. W. J. P. Gibbons; Sgt. S. Godson; Sgt. V. Graham; L.A/C. R. Jackson; Sgt. L. J. Milton; Sgt. N. J. Morley; L.A/C. J. Perkins; L.A/C. O. J. Rigney; Sgt. L. C. Salmon; Sgt. W. E. Seckington; Wing Cdr. J. D. Stephens, D.F.C.; F/O. V. St. John; Sgt. A. Young.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. R. Eadie.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. F. L. Ayley.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. W. H. Casement; Sgt. T. F. Costelow.

DIED ON ACTIVE SERVICE.—Flt. Lt. J. M. Barkla.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—P/O. G. W. Darling; F/O. H. J. Dothie; Sgt. N. R. Elford; Sgt. S. D. Hirst; Sgt. F. Lawrence; Sgt. E. R. McCunnell; Sgt. E. C. Nicholson.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. V. N. Ballard; Act. Flt. Lt. B. L. Buls; F/O. A. G. Edwards; Sgt. J. W. J. Gill; F/O. J. H. Moore; Sgt. E. A. S. Tucker; P/O. G. M. Waldie.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. N. M. Davis; Flt. Sgt. E. E. Deverell; Flt. Sgt. J. C. Perry.

MISSING.—F/O. G. B. Clement; P/O. D. D. Curtis; Flt. Sgt. A. D. Drewe; Flt. Sgt. G. S. Fairbairn; W/O. A. D. Finlayson, D.F.M.; Flt. Sgt. F. E. Gee; Flt. Sgt. A. Harlem; F/O. A. M. Lutz, D.F.C.; F/O. C. R. Norton; Flt. Sgt. A. J. Pepperrell; Sgt. J. P. Sheridan; Flt. Sgt. H. J. Simpson; Flt. Sgt. R. J. Singer; P/O. J. Taylor.

KILLED ON ACTIVE SERVICE.—P/O. J. F. Curtis; P/O. S. K. Lowry; Flt. Sgt. T. D. Phillips; Flt. Sgt. L. A. Taylor.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. A. H. Bransby.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. M. J. A. Wyllie.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. W. B. Anderson; Flt. Sgt. H. C. Beebe; F/O. L. W. Birkinshaw; Sgt. K. G. Curtis; Sgt. A. D. Foote; Sgt. W. Harvey; Sgt. A. J. Keeney; Sgt. F. M. Lacasse; F/O. T. T. Lundberg; P/O. G. D. MacDougall; Sgt. J. Perry; Sgt. D. H. B. Powell; F/O. S. C. Shusterove; F/O. M. J. Sumstrun; Sgt. S. V. Woyce.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. E. G. Crockett; F/O. J. C. Frizzell; Flt. Sgt. W. St. C. Hebb; Sgt. W. MacKillon; Sgt. D. J. Mullen; Sgt. J. W. McL. Renwick; Flt. Lt. O. B. Robertson; Sgt. D. A. Ross.

MISSING.—Sgt. B. A. Anderson; P/O. C. H. Anderson; Sgt. D. G. Booth; F/O. H. A. Danniger; Sgt. A. A. Frederickson; Flt. Sgt. R. D. Hayes; Sgt. R. G. James; Sgt. G. Kareza; Sgt. F. Kelloway; F/O. F. E. Lewis, D.F.C.; Flt. Sgt. R. E. Lindsay; F/O. G. A. Shannon; F/O. F. G. Spanner; F/O. J. A. Studer; Sgt. G. A. Usher; F/O. R. D. L. Vietto; Flt. Lt. J. D. Waterman, D.F.C.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. K.-C. Sanderson.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. T. E. Coles.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. A. B. Coburn; Sgt. C. R. Davey.

MISSING.—F/O. R. O. French.

KILLED ON ACTIVE SERVICE.—F/O. J. H. Heath.

South African Air Force

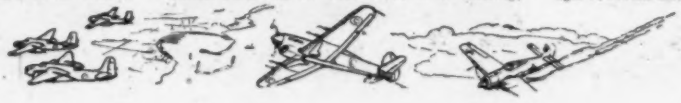
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Act. Flt. Sgt. C. Engelbrecht; Lt. S. Lindenburg.

MISSING, BELIEVED KILLED IN ACTION.—Lt. R. L. Cherrington.

Official Corrections

Casualty Communiqué No. 305.

Under MISSING, delete Flt. Lt. D. HAYWOOD, Sgt. J. McCALLUM and Sgt. M. PEARCE.



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t. H. J.
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t. D. J.
t. O. B.

C. H.
A. Dan-
R. D.
a; Sgt.
lt. Sgt.
F. G.
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